Successful Methods

Construction - Road Making - Engineering - Industrial - Mining

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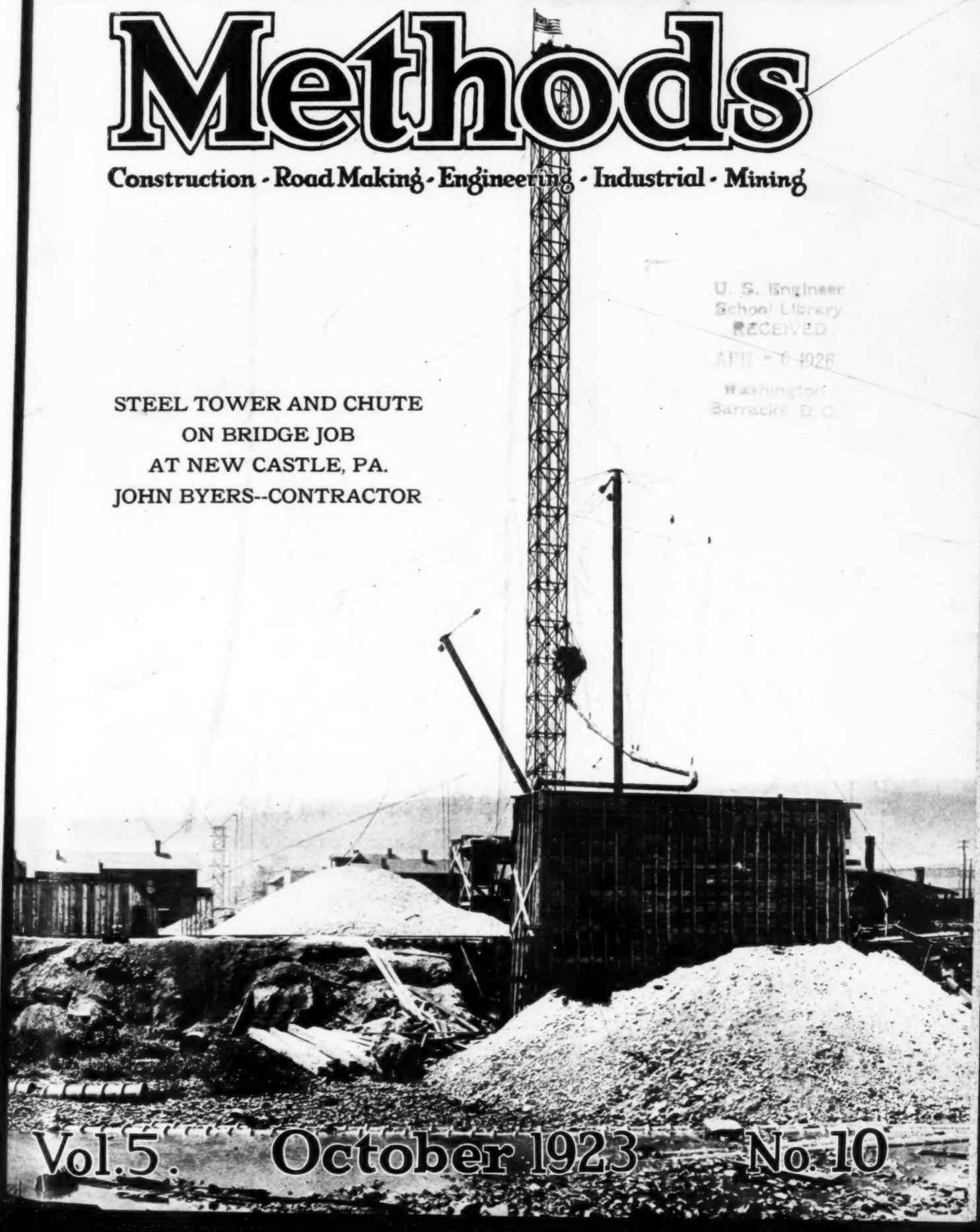
STEEL TOWER AND CHUTE
ON BRIDGE JOB
AT NEW CASTLE, PA.
JOHN BYERS--CONTRACTOR



Vol. 5. October 1923 No. 10

FIRST AID

TO THE EARTH MOVER

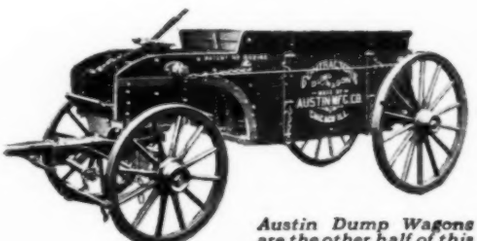
WHEN you need it, think of the New Era elevating grader. Where conditions are such that we recommend this machine, you can rest assured that your job will be done quicker and cheaper than you could do it in any other way.

"Can't I use a New Era?" should be your first question always. It can be answered affirmatively more often than you might think and the effect on the pocketbook is extremely gratifying.

Let us figure with you on a New Era for your next earth moving job. You can't lose, and stand a much better chance of being the low bidder on new work, or making some extra "velvet" on a contract that you already have.

Austin Manufacturing Co.

New York CHICAGO San Francisco



Austin Dump Wagons are the other half of this time - saving, money - making combination.

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Successful Methods

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Vol. 5 OCTOBER, 1923 No. 10

Is It Sound Business?

NORTH CAROLINA is completing an average of about three miles of hard-surfaced highways every working day. Two or three other States are putting money into improved highways just about as fast. Several million dollars of capital are being tied up daily by the road-building program of the country. We are going ahead with such work at a pace that is hard to grasp. Many keen, experienced men have lately begun to ask, "Is it sound business?"

Only a few of those who are directly interested in the continued expansion of highway building have sensed this questioning by people who will sooner or later have to be answered with facts, and not theories. Generalities are not going to get anywhere when the showdown comes. The only argument that will count will be tangible facts that will prove that a sufficient direct return is being earned on the investment to pay the interest and retire the bonds.

Thus far very few concrete facts have been assembled showing state-wide or nation-wide actual savings or earnings directly due to road improvements. Any good-roads enthusiast can spout by the hour in generalities. Little evidence that will pass muster in the coming fight has thus far been brought to light. There is plenty of such evidence; it simply has not been assembled and presented.

For example, in North Carolina very accurate figures show that the gasoline consumption per motor vehicle in the 1921 fiscal year averaged about 510 gallons. In 1922 this had been reduced to 450 gallons. The reduction this year is expected to be more. It would be safe to credit a saving of at least 60 gallons for each of the 225,000 motor vehicles in the State to the road improvements made in the meantime. At current prices this amounts to about $3,300,000 a year, which is over $500,000 more than the entire annual present cost of highway maintenance in the State.

Throughout the nation improved highways are earning similar vast direct earnings. Men who have closely studied the facts know that money properly spent in improving highways shows a quick, handsome return. The time has come to begin to assemble the sort of facts that will be accepted as evidence that our tremendous highway improvement program is financially sound.

Summer and Winter Costs

THE business manager of one of the largest firms of architects in the country recently made a startling disclosure regarding the comparative cost of laying brick in the winter as compared with the cost of exactly the same kind of work in the summer. He says that summer brick work costs almost two and a half times as much as jobs done in the winter.

These figures are not guesses. They are based on actual costs on a great volume of work. They simply show that bricklayers are independent when there is a shortage of men in the summer, and that they do a day's work in the winter when jobs are scarce.

With pitiful slowness, engineers, architects and contractors are awakening to the complete change which has occurred in the construction business in the last few years. So long as present conditions continue there are very few jobs which cannot be done as cheaply in the winter as in the summer.

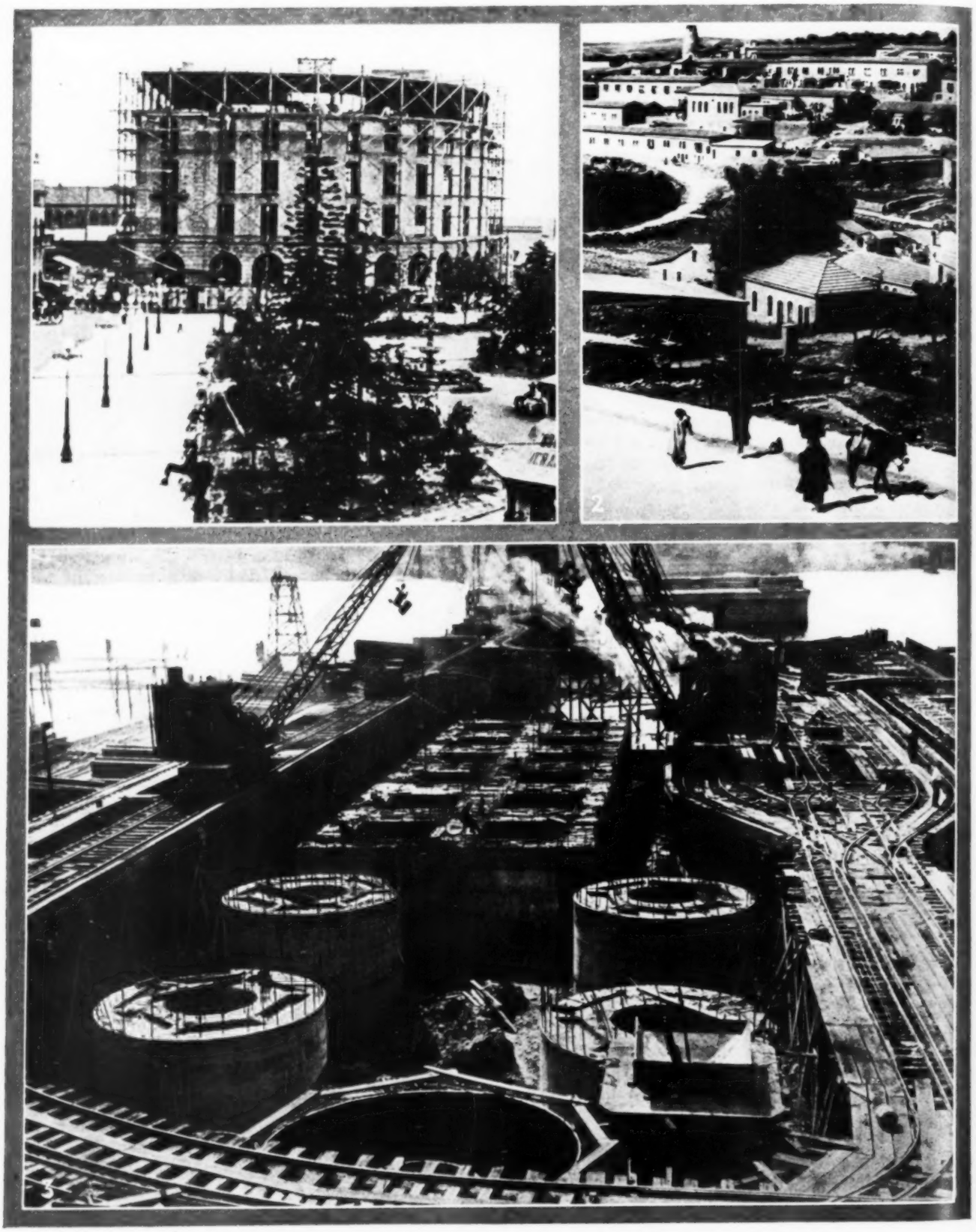
A Day's Work

NO argument is necessary to prove that the efficiency of construction labor is steadily declining. Nor is it necessary to go into details to prove why. The sad fact is that men simply do not do a real day's work any more. The worst of the situation is that there seems to be little prospect of relief. Certainly restrictions on immigration are not going to be eased; they are more likely to be increased. The union movement is gaining strength constantly. Other conditions all point to less and less efficient labor on construction jobs.

Contractors complain of their inability to make money because of this situation. The facts are that very few are making any money. Nor is this surprising in view of the amount of work still done by hand or by methods that were out of date before the war. In spite of our boasts we still depend largely on hand labor, although many a losing job could be turned into a profit by using machines instead of men.

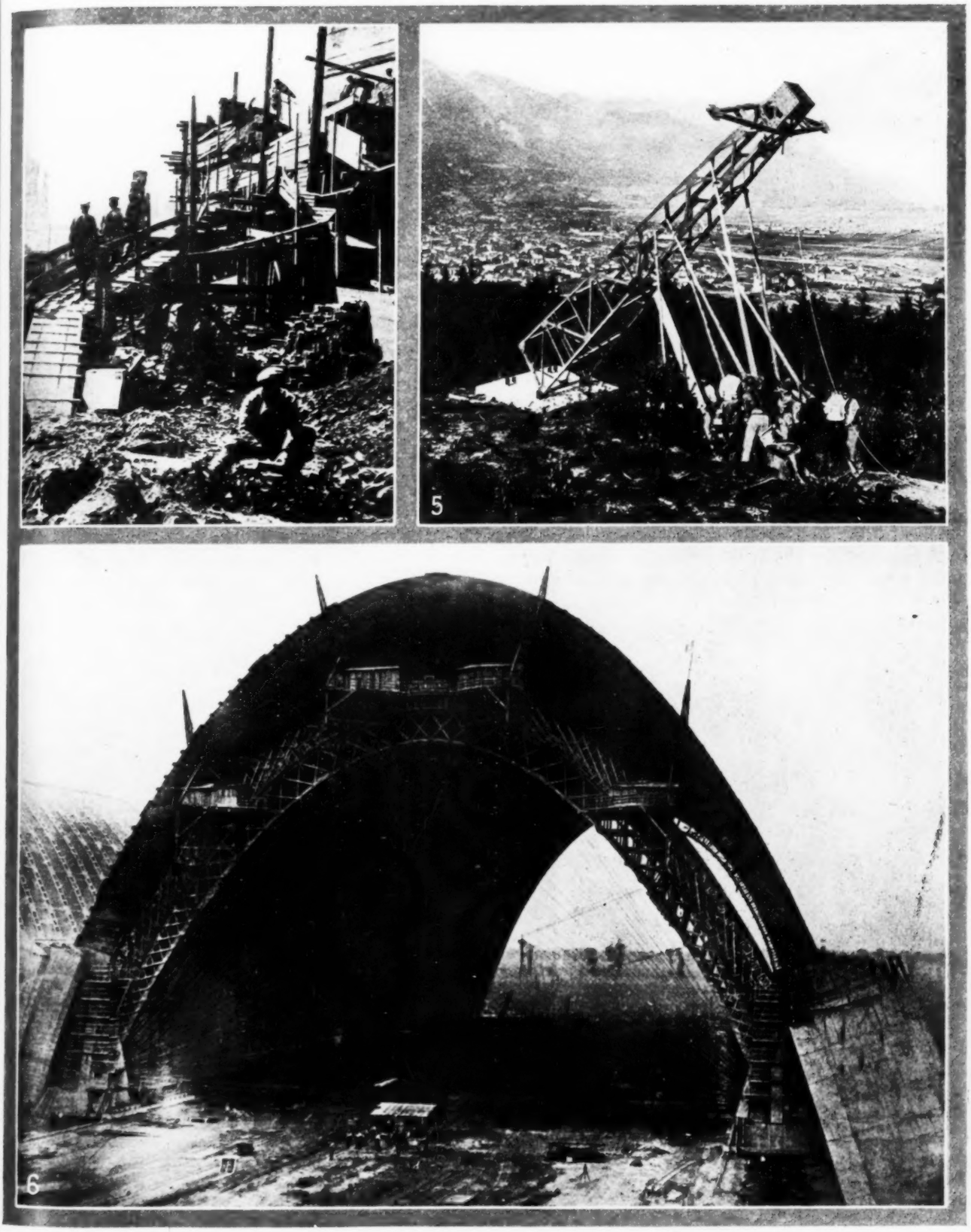
Low labor efficiency and competition are going to force contractors who stick to hand labor either to quit or to follow the lead of successful concerns and use machines wherever they will replace men to advantage. And it is well to keep in mind that machines are making good on small jobs where they would have been impractical a few years ago.

Six Construction Jobs



1—The semi-circular building shown in this photograph is the new electric light and power building at Tampico, Mex., said to be the finest office building in the country. © *P & A Photos*
2—The new type of buildings which are being put up by the Jewish community in Palestine. © *Keystone*
3—Philadelphia's great construction achievement—the Delaware River Bridge. This shows one of the piers in the river and the caissons and foundations on the Camden side of the river. © *P & A Photos*

From Six Nations



4—The hit-or-miss building methods employed in Soviet Russia. Workmen are restoring a building destroyed during the Revolution. © *International*

5—Austria is developing its hydro-electric resources and this photograph shows the erection of one of the transmission towers for the Innsbruck-Telfs railroad. © *International*

6—This enormous structure is a hangar built of steel and concrete which is being put up at Orly, near Paris. It will house dirigible balloons. © *International*

NEW BRIDGES FOR OLD

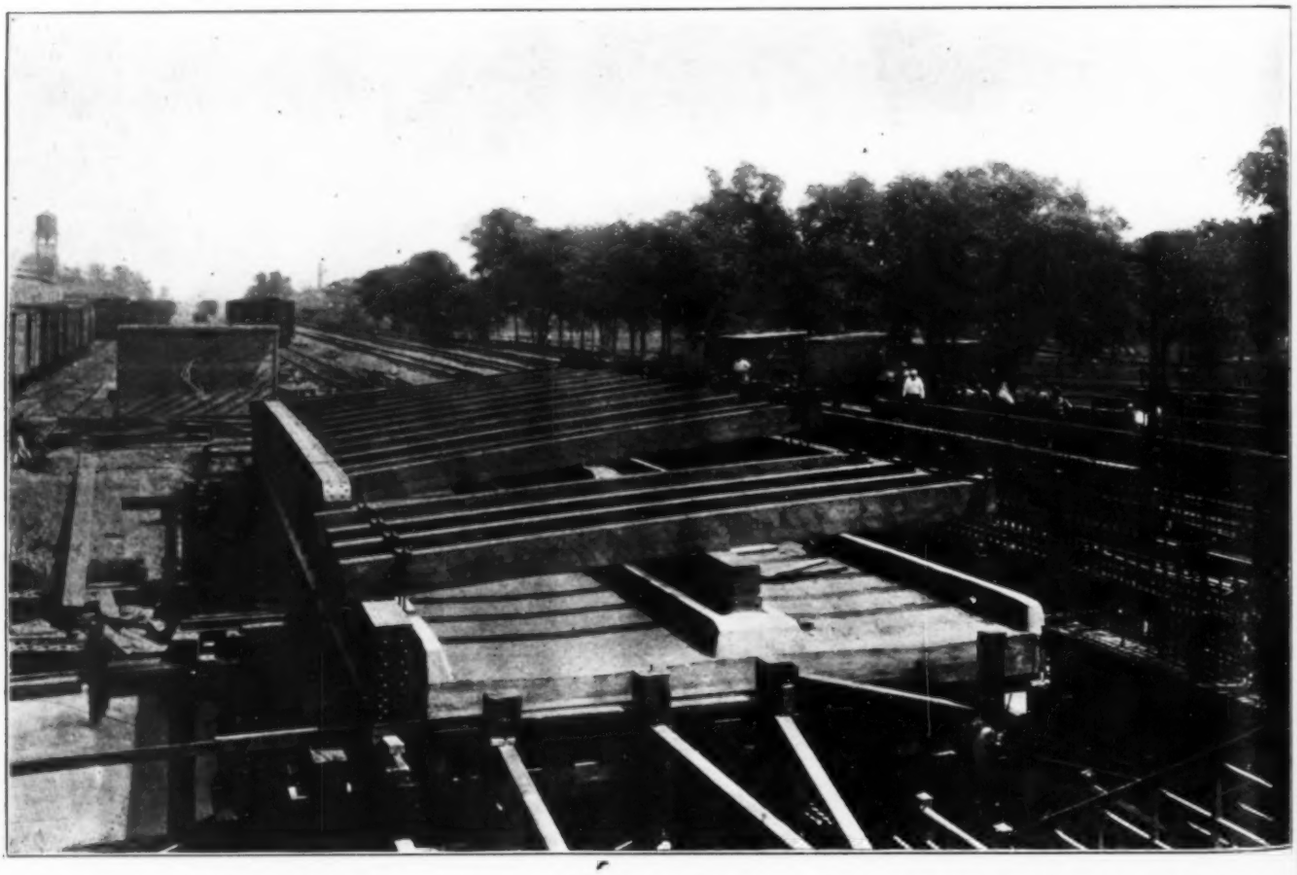
Replacement of Old Structures on Pennsylvania System Accomplished Without Delaying Heavy Traffic

REPLACEMENT of old structures to meet the demands of modern traffic is a pressing problem with many railroads at the present time. Changes in the character of the equipment used on modern roadbeds have rendered obsolete many of the bridges and other structures built twenty-five or thirty years ago. The Pennsylvania Railroad is solving such a problem at Elizabeth, N. J., where five steel bridges of the open-floor type, built in 1896, are being replaced by new bridges with I-beam floors encased in concrete, thus making the floor system solid.

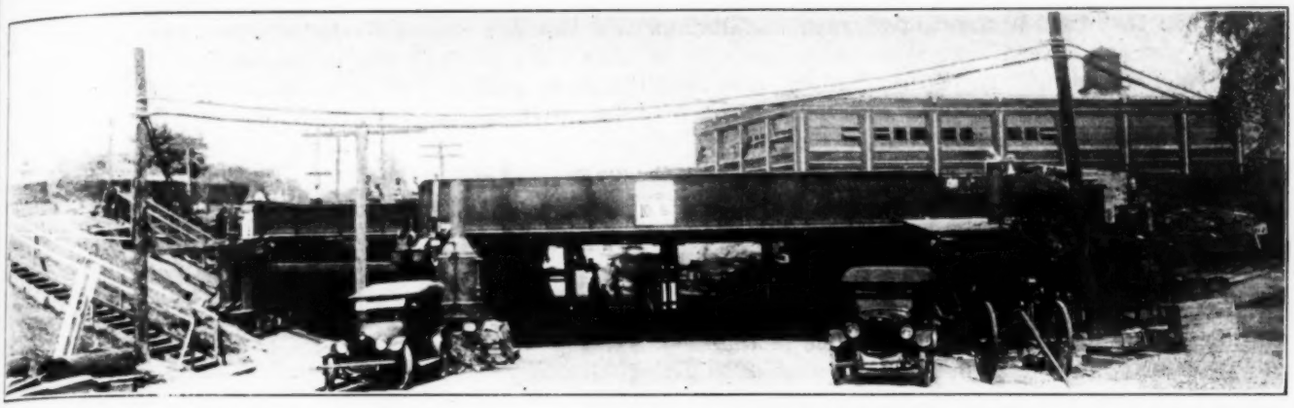
These five bridges cross important streets in Elizabeth and carry a traffic of 1000 trains a day. It can easily be seen, therefore, that the replacement of these old bridges with modern structures was no easy job. It was necessary to delay traffic on the railroad as little as possible and also to keep the streets underneath open.

The plan decided upon by N. B. Pitcairn, division engineer, and B. F. Stidfole, Jr., master carpenter of the New York Division of the Pennsylvania Railroad, and performed to a successful conclusion by the contractors, Allen N. Spooner & Son, Inc., of New York City, provided for the building of the bridges in two sections, each section to carry two tracks, except in the case of one bridge which carries five tracks, one being built at the north side of the old structure and the other at the south side. Sunday mornings, between the hours of 4.30 and 10 o'clock, were chosen for the final operation of removing the old bridges and sliding the two halves of the new bridges into place. This was done because at that time traffic is lightest and there was practically no interference. As a matter of fact, on the three bridges that have been put in place at the time of writing, the work was completed almost two hours ahead of schedule. A thorough discussion of the methods used in this work follows:

The old structures were for a track center 12 ft. 2 in., and no change was made in these centers. Therefore, it was necessary to remove the old curb column foundations, change the 16-in. bridge sets and replace them with 3-ft. concrete bridge sets. The foundations for the curb columns of the new structures were 17 in. lower than the old foundations. Thus it was necessary to shore the old bridges to carry the traffic of several hundred trains a day without interruption, and to remove these columns and their foundations. These were supported on frame bents. These frame bents were utilized for the installation of the new superstructure, the bents being extended on the north and south sides far enough to receive the new superstructures, each carrying two tracks, for as-



NORTH SIDE OF NEW BRIDGE SHOWING CANTILEVER SUPPORTING FLOOR SYSTEM BEFORE INSTALLATION



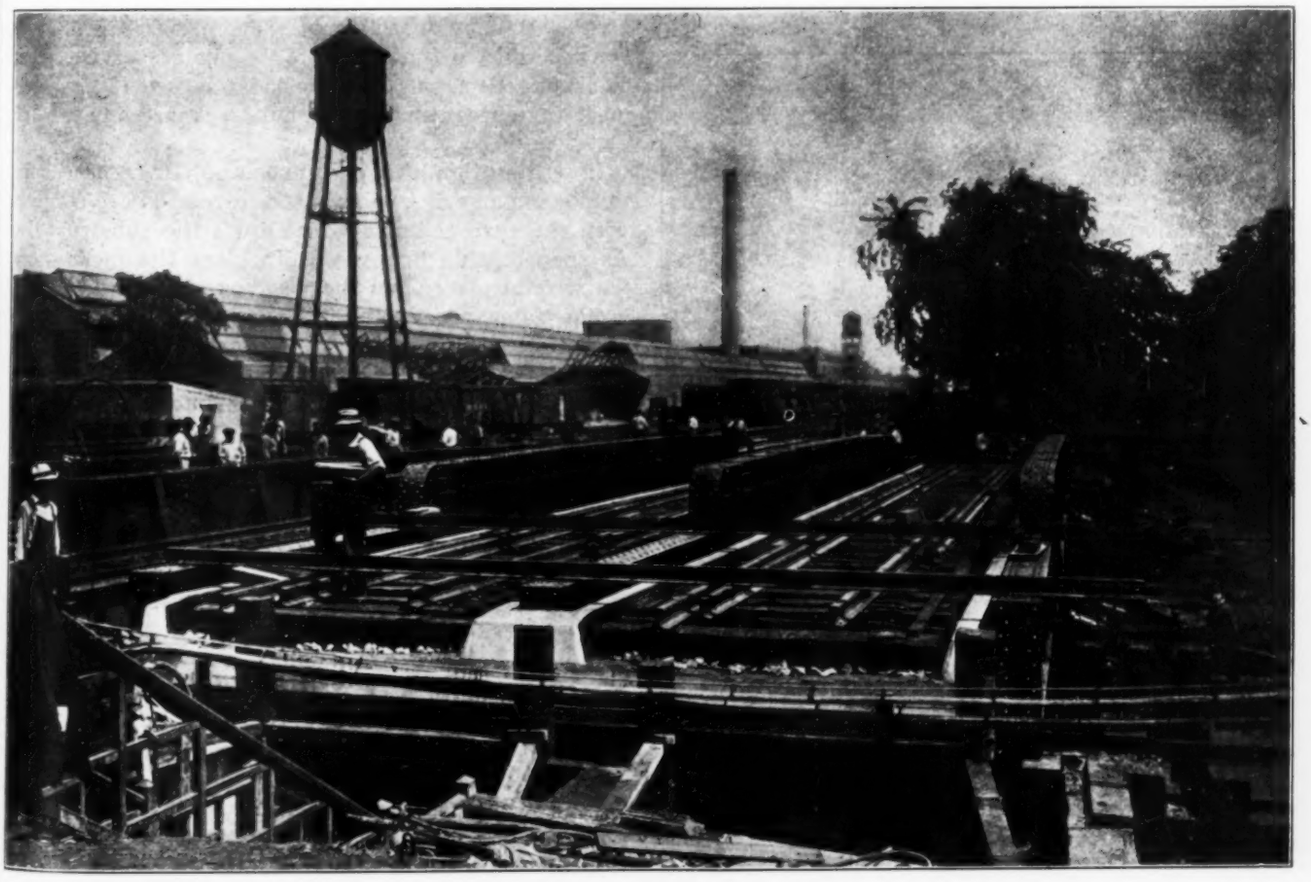
OLD STRUCTURE SHOWING HOISTING ENGINES IN PLACE READY TO MAKE PULL. CENTER BENTS AND FALSE WORK SUPPORTING STRUCTURE

sembling and installation. The columns for the new superstructure were placed as the foundations were completed, so as to eliminate the necessity of hanging them and carrying them during the new installation.

After the false work was completed the girders were set for two tracks on the north side, the floor system was installed, forms applied, and concrete poured. After the concrete had set for a period of fourteen days the bridge was jacked up ½ in. and the middle girders were removed and taken to the south side to go through the same process. The method used to permit the removal of these girders is a cantilever of 10 by 16 long leaf yellow pine timbers with 1¼-in. rods supporting the floor to the cantilever timbers.

After the girders were removed to the south side, having served their purpose as a templet, they were placed on the north side and the same process gone through of assembling the steel forms for the reception of the concrete. The concrete was then poured and after a period of fourteen days this bridge was ready for installation.

The two sections of the bridge were then put in place by the sliding method. For this purpose 100-lb. P. S. rails were used, and the power was supplied by two hoisting engines located in the street on the north side of the bridge. Also four sets of 4-fold blocks reeved with 5½-in. line. The necessity for such heavy blocks and falls and the two engines was



SOUTH SIDE READY FOR INSTALLATION. THE RAILS ON WHICH THE STRUCTURE SLIDES INTO PLACE MAY BE SEEN UNDERNEATH THE NEW BRIDGE

due to the fact that it was a two-track installation and the weight of the tracks and the concrete made it a 400-ton movement. Three installations have been made to date, with two bridges remaining to be installed. This will complete the entire project for 1923.

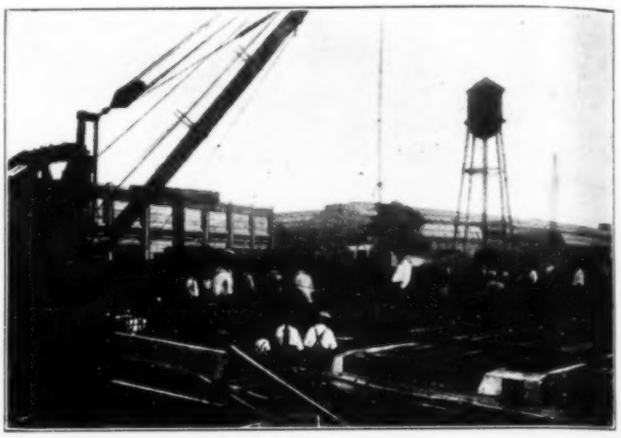
The method used for the installation of all three bridges was the same in each case and little variation in time of installation was made, as the whole program was carried out on a time basis. At 4.30 a. m. Eastern Standard time, derricks were located at South Elizabeth, with all the equipment for the installation, and promptly on the minute were started to the bridges. This equipment consisted of a 60-ton 60-ft. boom derrick on one side and a 12-ton 40-ft. boom derrick on the opposite corner. As soon as these derricks had gone over the bridge, the cars were placed for the reception of the old superstructure.

The floor system of the superstructure had been prepared by cutting out the rivets and putting in temporary bolting on the previous day. The floor beams between tracks 2 and 3 were burned off and supported with false work consisting of stringers and frame bents.

When the tracks were removed, the derricks began to remove the ties and floor system, placing them in the cars. After the floor system was out of the way the derricks at their respective ends removed the pony girders. After the pony girders were removed both derricks picked up the outside main girder, moved it to center and shifted it toward the large derrick, this being necessary because of the fact that it was an 85-ft.

LIFTING THE MAIN GIRDER OF OLD BRIDGE WITH 60-TON DERRICK

reach and it was necessary to shift it toward the large derrick so it could get a center lift. This was accomplished by dropping the boom flat, as after getting the lift this derrick was able to boom up as great a load as it could lift with its main falls. One of the photographs shows the 60-ton derrick carrying back and loading on a car the main span, which weighs about 40 tons. Immediately after the girders were removed the sliding rails were placed for installation. These, of course, were on both ends. The old superstructure having now been removed, the sliding rails set, and the guide rails having been previously placed, the new superstructure was pulled into position, this job consuming but 3 minutes. After it was put in place it was necessary to pick the bridge up to a freeing point and to remove the sliding guide rails, etc. The bridge was then lowered to the bridge seats. This was done with sixteen hydraulic jacks,



TAKING OUT THE PONY SPANS WITH 12-TON DERRICK

eight 100-ton jacks, and four 80-ton jacks, and four 60-ton jacks, it being necessary to lower this bridge 8 in. As soon as the bridge was in its location the track men began making the connection of the rails, ballast was strewn, and the tracks placed in service at the 30-mile speed limit. The program for this work permitted the tracks to be out of service from 4.30 until 10 a. m. This period was provided for to meet any unseen emergency, but tracks were in service at 8.30.

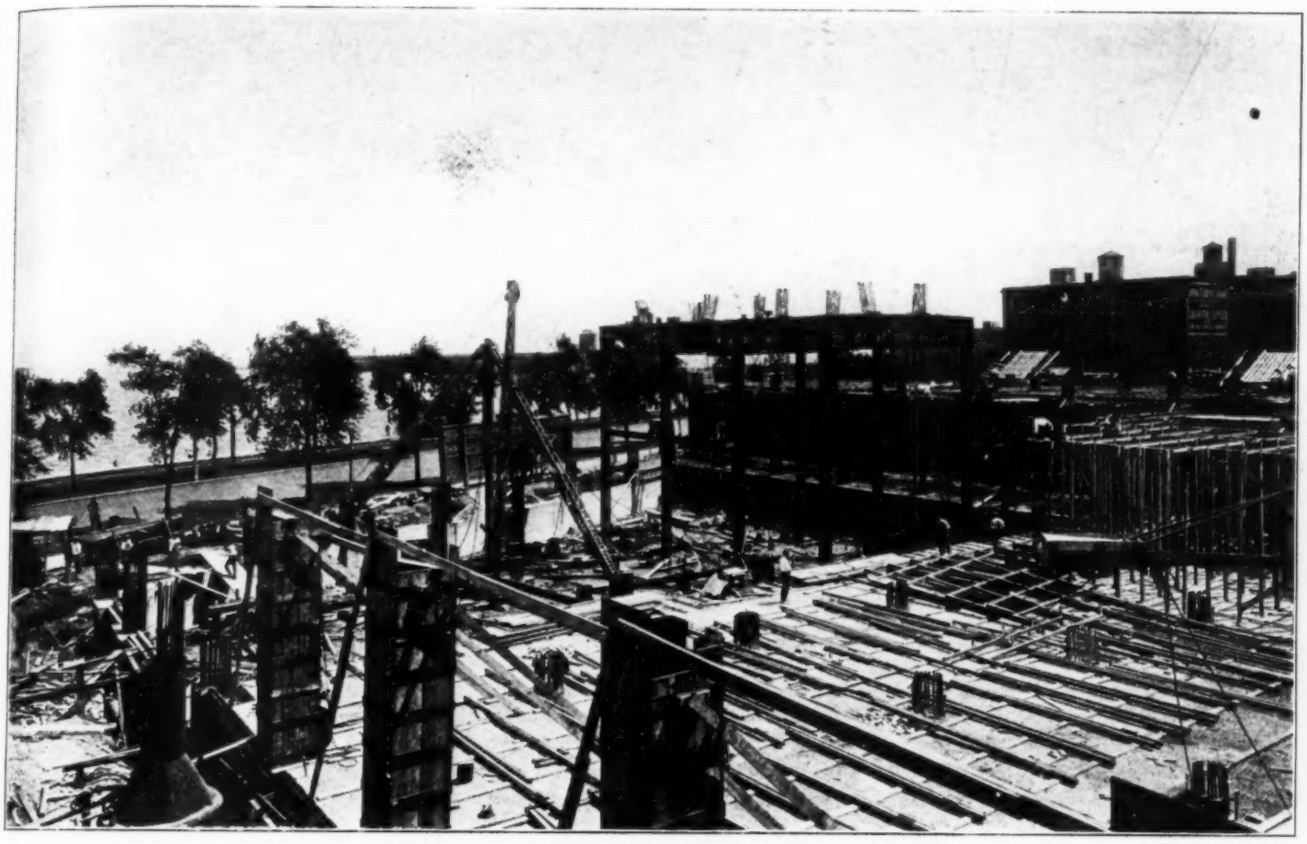
In pulling this bridge into position it was necessary to move to an exact point, as the girder had to connect with the curb columns which form the substructure. As soon as this bridge was in place the jacks were moved and placed for the westbound installation.

The same process was gone through for this installation. Measurements were taken and each checked, as it was necessary not only to connect the main girder to the curb columns but the cantilever floor system must connect with the main girder. In pulling this in place it was stopped 10 in. from the main girder, in order to check whether the structure was coming correctly in line and to provide for any side movement necessary. After it was found to be in line, the 10-in. stop was removed and the connecting girders pulled to place.

It was then necessary to jack this bridge up and remove the slide rails and place a $\frac{5}{8}$-in. plate at the bearing point to permit the gusset plates to go under the girder. When this had been accomplished the bridge was pulled home and connected. The cantilever timbers and rods were removed at once, the trackmen connected the track, strewed the ballast, and immediately placed the track in service for the movement of trains. This operation took from 11 o'clock until 3 o'clock. These operations did not delay any of the train schedules, freight or passenger.

MAKING SPEED ON BIG BUILDING JOB

Chicago's "Furniture Mart" Is Going Up at Rate of One Floor Per Week



WORK on the American Furniture Mart Building in Chicago has reached the point where steady progress is assured. From now on the slogan is "a floor a week," with the roof poured before the snow flies. It is confidently hoped that the immense structure will be virtually complete early in 1924, and that it will be in readiness for the national housewarming for the June-July market. This is to be a sixteen-story building, and will stand within a short distance of Lake Michigan. It will cover the entire block between Erie and Huron streets, with a frontage of 218 ft. on the Lake Shore Drive and extending back for a distance of 466 ft. to McClurg Court. It is declared by the builders to be the largest building ever erected for purposes of this sort. The fact that it has 90,000 sq. ft. of floor space per floor, or a total area of nearly 1,500,000 sq. ft., is of itself the best proof that this is an unusual undertaking, one that has called for careful planning and cooperation to assure its success.

The building is of reinforced concrete. For the floor construction the joist and metal dome system is being used. There will be a total of 75,000 cu. yd. of concrete in the building; approximately 7000 tons of reinforcing steel will be required, and 6,000,000 bricks. The work of pile driving has been slow and has taken considerable time. There were in all 7302 of these 50-ft. piles driven. Each group of 50 piles was capped by a concrete base, upon which the building will rest. The three lower stories are to be faced on the three street sides with terra cotta. Gray face brick and terra cotta trimmings will be used from the third floor up.

Wells Brothers Construction Co., Chicago, are the contractors; W. A. Forshee is superintendent of construction.

TEN STANDARD CONCRETE MIXERS

MANUFACTURERS of concrete mixers will begin as soon as possible to put the new standard plates on all machines which they turn out. These plates, ten in number, cover the different sizes of mixers which have been agreed upon as the ones which should be continued in general use and bear the seal of the Associated General Contractors, as well as a table showing the amount of cement needed.

It is expected that complete standardization will be reached before January, 1924. At present both the 12E and 13E paving mixers are regarded as standard, but ultimately one of them will be discontinued according to results of a referendum among the members of the Associated General Contractors.

FRESNOES AND GRADERS ON RAILWAY WORK

North and South Road in Wyoming Is Making Good Use of Them

By C. P. BURTON

IT is difficult for contractors and engineers whose experience is confined to New England and other Atlantic Coast States to realize to what extent elevating graders and fresnoes are used in the West. One Maine engineer, who recently became connected with the State Highway Department of South Dakota, had never seen a fresno in operation until he took his present position, although, of course, he was familiar with their performance from his reading.

In the States of Montana and Wyoming at the present time a new railroad is being constructed, more than 300 miles long, to connect two great belts of east and west transcontinental railways, and the work is being done almost entirely with elevating graders and fresno scrapers. There are a few small steam shovels on the job and one dragline, but elevating graders and fresnoes predominate largely. Fresnoes are even being used for doing work which ordinarily would be a steam shovel job because of the inaccessibility of the place and the difficulty of installing steam shovels.

Special interest attaches to this work, as it is the first new railroad construction of importance which has been undertaken in many years. The moving spirit in promoting the new line is Charles S. Haskell, former Governor of Oklahoma. Governor Haskell is

ELEVATING GRADER AND DUMP WAGONS IN USE ON JOB. THE UPPER PHOTOGRAPH SHOWS FRESNOES ENGAGED IN HEAVY GRADING WORK

THE KIND OF JOB THAT MAKES THE ELEVATING GRADER SO POPULAR WITH RAILROAD CONTRACTORS

largely interested in oil fields, and his first idea was to build a pipe line from the Wyoming oil fields around Casper, in a northerly direction to the Chicago, Milwaukee & St. Paul Railroad, through territory in which there is no railroad transportation. He found that the pipe line would cost $25,000 a mile and, therefore, developed a plan to build a railroad through the same territory.

The new line will be known as the North & South Railroad. It starts at Casper, Wyoming, operates over the Chicago & Northwestern Railroad as far as Illco siding, and runs from there to Salt Creek, center of the great oil development; from there it will extend north to Miles City, Montana, paralleling the Big Horn Mountains for 100 miles, and will follow the valleys of Prairie Dog Creek and Tongue River to Miles City, where the water of these streams flow into the Yellowstone River. There connection with the Chicago, Milwaukee & St. Paul Railroad will be made. The new line will be 330 miles long and eventually may be extended south 100 miles to Rawlins.

The photographs accompanying this article give a good idea of the way the machines are handling the work. On page 8 fresnoes are shown taking care of the heavy grading for the roadbed. The lower photograph on the same page illustrates the use of the elevating grader in conjunction with dump wagons. The grader is operated by one man, although in the photograph two men are riding upon it. A loaded wagon has just left the machine and another is taking on a load under the elevator. The speed with which the grader works makes it possible for the wagons to keep coming in a constant stream to be filled and little time is wasted by delay in having the wagons filled promptly. The photograph at the top of this page shows a typical job done by the elevating grader. The lower photograph shows a fresno working on a section of the road.

The new railroad began operation in September between Casper and Salt Creek. A year's extension of time has been given for the completion of the remainder of the work. The construction of the railroad is in the hands of George M. Huss, who was Assistant Director of the Railroad Administration during the war and is vice-president of the North & South Railroad Company. The general contractors are Roberts Brothers, Peterson, Shirley & Gunther, of Chicago and Omaha. The grading is being done entirely by sub-contractors. The photographs accompanying this article were taken at various points on the new line. The picture at the top of this page shows a cut that was made entirely with an elevating grader. The driver of the fresno in the lower photograph is a full-blooded Indian. A large number of Indians are employed.

THE FRESNO DOES ITS PART IN EFFICIENT GRADING

PERMANENT REPAIRS TO STEEL PIPE LINES

Newark Water Department Makes Success of Electric Arc Welding

By J. A. FOULKS, Chief Engineer,
Dept. of Streets and Public Improvements, Newark, N. J.

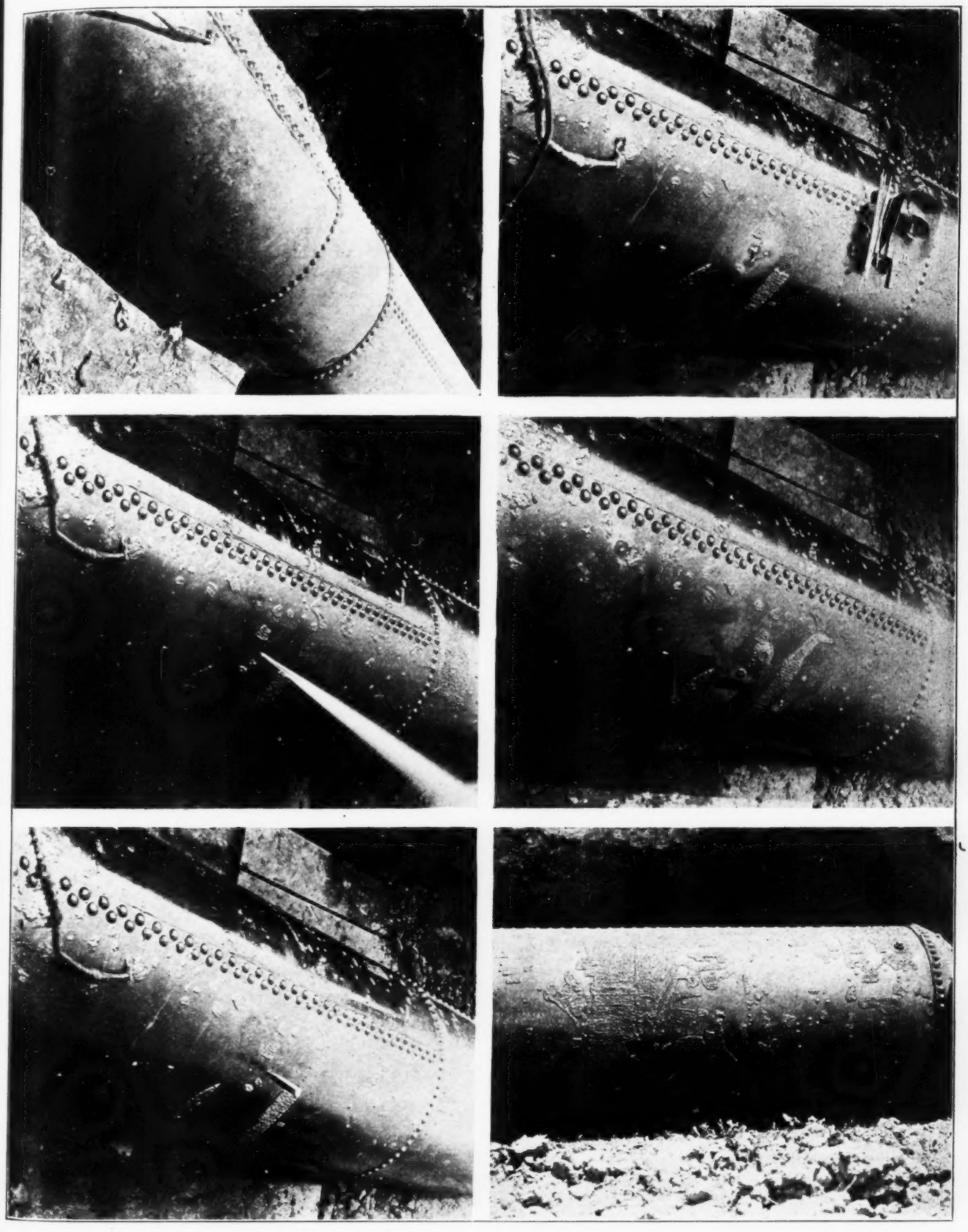
IN 1891 and 1904 the City of Newark laid 54 miles of 36-in., 42-in., 48-in. and 60-in. riveted steel pipe, which has given very satisfactory service. A surface inspection was made in 1922 by digging test holes, showing the pipe to be in excellent condition except in a few locations where the lines run through wet or swampy places. At these places the surface was found to be pitted badly, the deeper pits giving way from time to time, causing small leaks. The real cause for this condition has not been determined definitely. It may be due to stray current action, to the soil, or to a combination of both. The soil is composed of a mixture of clay and sand, having strata running through it containing considerable organic matter, and it is interesting to note that most of the pits occur on the upper third of the pipe, especially where the organic matter comes in contact with the surface.

When the leaks were discovered, by the appearance of water on the surface of the ground, they were repaired in various ways, until early in 1922, when they appeared more frequently and it became necessary to find a more permanent method of repair or replace sections of the line at considerable expense. Electric arc welding was tried and repairs were made with a motor generator set mounted on a small car chassis without shutting off the line, which carried a pressure of 90 lb., and the results have been very successful. The photographs on the opposite page show the various stages of the process. The first shows a portion of the 36-in. line, constructed of 5/16-in. plates, ready for repair. After thoroughly cleaning the pipe by scraping and brushing with wire brushes, it was washed with gasoline and the pits were filled and reinforced with metal, as shown in the remaining photograph. When a hole was found (see Nos. 2 and 3) it was plugged with pine and the plug was then cut off even with the surface of the pipe. A metal cap, slightly concave and obtained from punchings in a sheet steel plant, was then placed over the plug and held in place by tacking with the electric arc (see No. 4). The repair was then completed by welding around the cap, as shown in No. 5, making a tight, permanent repair.

Results of this work when first tried showed the following costs for repairing 10 ft.:

2 men, 8 hours	$12.50
1 laborer, 8 hours	4.56
Materials, including steel, gas, oil, etc.	2.10
Total	$19.16

A MOTOR GENERATOR SET MOUNTED ON SMALL CAR CHASSIS FURNISHED THE POWER



This makes an average cost of 77 cents per lin. ft. of pipe, not including the excavation and backfill.

Due to the recent dry weather, work could be carried on to advantage in places that were ordinarily troublesome on account of the presence of water, and approximately 2500 ft. have been completed. As the work progressed the line was found to be pitted very badly in places, which increased the cost to $2.09 per lin. ft. The sixth photograph shows a sample of a bad condition that has been repaired satisfactorily.

DIGS SEWER AND HANDLES PIPE

Crane Equipped with Clamshell Works in Hard Clay on Job at Perth Amboy, New Jersey

PERTH AMBOY, N. J., is famous for the production of terra cotta, but the clay which gives the town its reputation is so tough that it provides a hard job when any excavating is to be done.

G. A. McLaughlin, a local contractor, has a 3-mile sewer job on his hands. And he is digging the trench with a clamshell bucket operated by a crane mounted on a motor truck. At the time of writing he has

THE CRANE AT WORK

completed about 3500 ft. and has been making progress at the rate of 15 ft. per hr. The average depth of the trench is 9 ft. and it is 4 ft. wide. The surface soil consists of 3 to 4 ft. of stiff yellow clay, and under this is a deep stratum of the tough blue terra cotta clay. This underlying material is just about as hard stuff as it is possible to dig with a clamshell bucket. The two photographs on this page show the bucket digging in this clay.

Before the trench was started the clamshell excavated a septic tank, the excavation being about 29 by 42 by 9 ft. and requiring the removal of about 425 cu. yd. of material. Working with a swing that averaged more than 90 deg. and with an average lift of about 11 ft., the crane dug and delivered the 425 cu. yd. of material to motor trucks in 33 hr. It would have made even faster time but for the fact that the trucks were delayed by bad going. With a sufficient number of trucks to handle the material the crane ought to be able to average 15 yd. an hour.

When the excavation for the septic tank had been finished the crane was put to work on the trench, digging the trench and laying pipe, where it is still engaged. While it was at this work, about a block away, about 45 yd. of material slipped back into the excavation for the tank. The crane was hustled back, a tip-over bucket substituted for the clamshell because of the fact that the clamshell was too big to use among the forms and the material that had slipped back into the excavation was all cleaned up in about 4 hr.

In laying the pipe, the crane handles 4 ft. sections of 36-in. precast concrete pipe, each weighing 2300 lb. It placed them at the rate of 48 ft. per hour. Mr. McLaughlin, in discussing the job, pointed out that he was able to do the excavating without the necessity of using floats or other artificial foundations for the crane. In addition he figured that he saved considerable money because of the fact that he could run the crane back at a rapid rate along the side of the ditch in order to place the pipe.

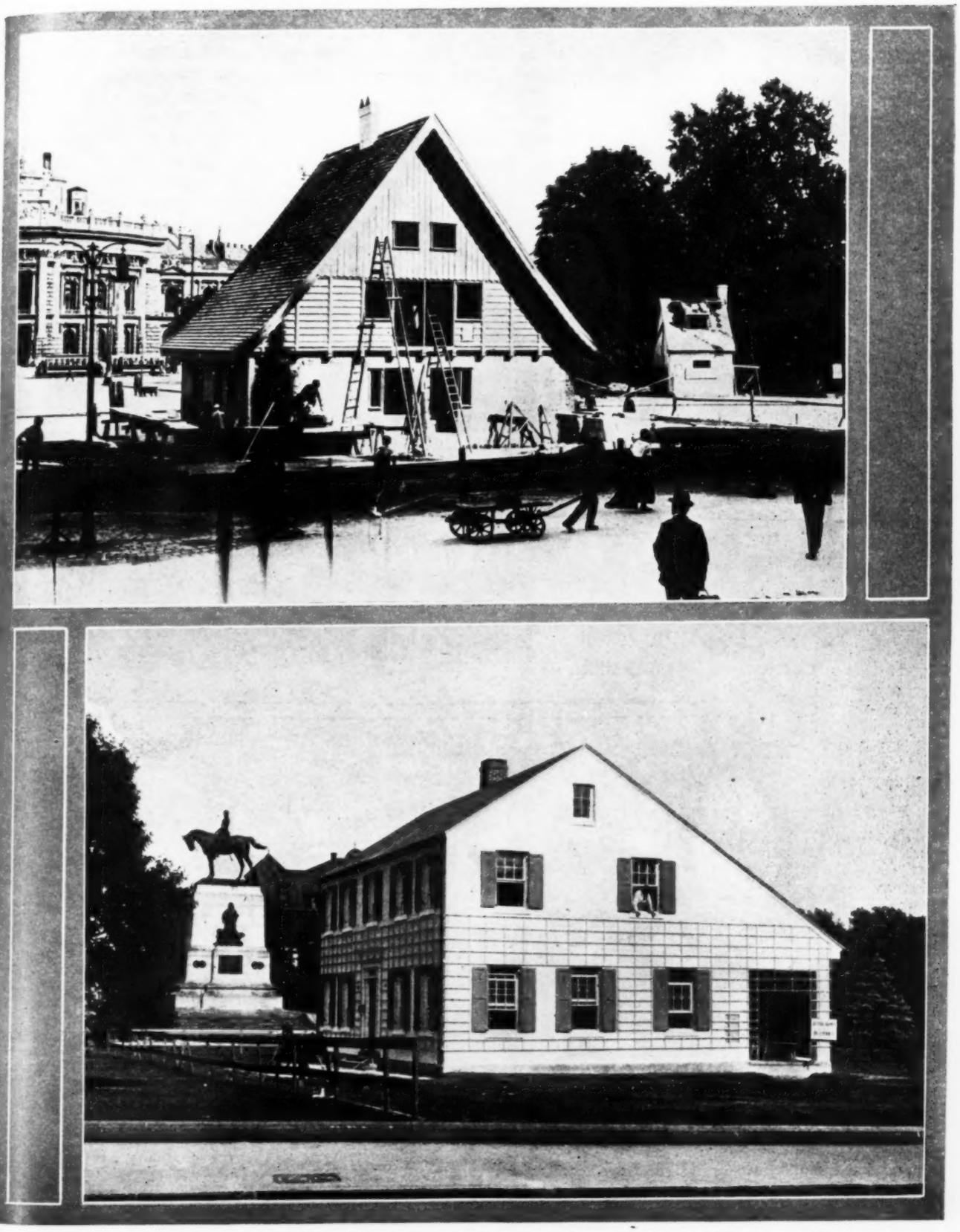
In placing the pipe, the crane was used to hold each

DIGGING IN AND PICKING UP A FULL LOAD

length in place until it could be blocked accurately to grade and line. The joints were grouted later.

In all the operations described, the crane is enabled to keep on solid ground. In trenching it is ahead of the trench which it is excavating and when placing the pipe it simply moves along at the side. This ability to keep on a firm footing, which has been mentioned above, added greatly to the efficiency of the crane's performance. As the job progresses the crane has gradually increased the speed with which it handles the various operations.

For the Homebuilders



The model home idea is in fashion on both sides of the Atlantic. The upper photograph shows a model home put up in a public square in Vienna by the City Council. This sort of house can be built for about $500 paid in small installments. The lower photograph shows the American version of the model home. It stands near the Treasury Building in Washington. © *P & A Photos*

GOOD PROGRESS ON TIETON DAM

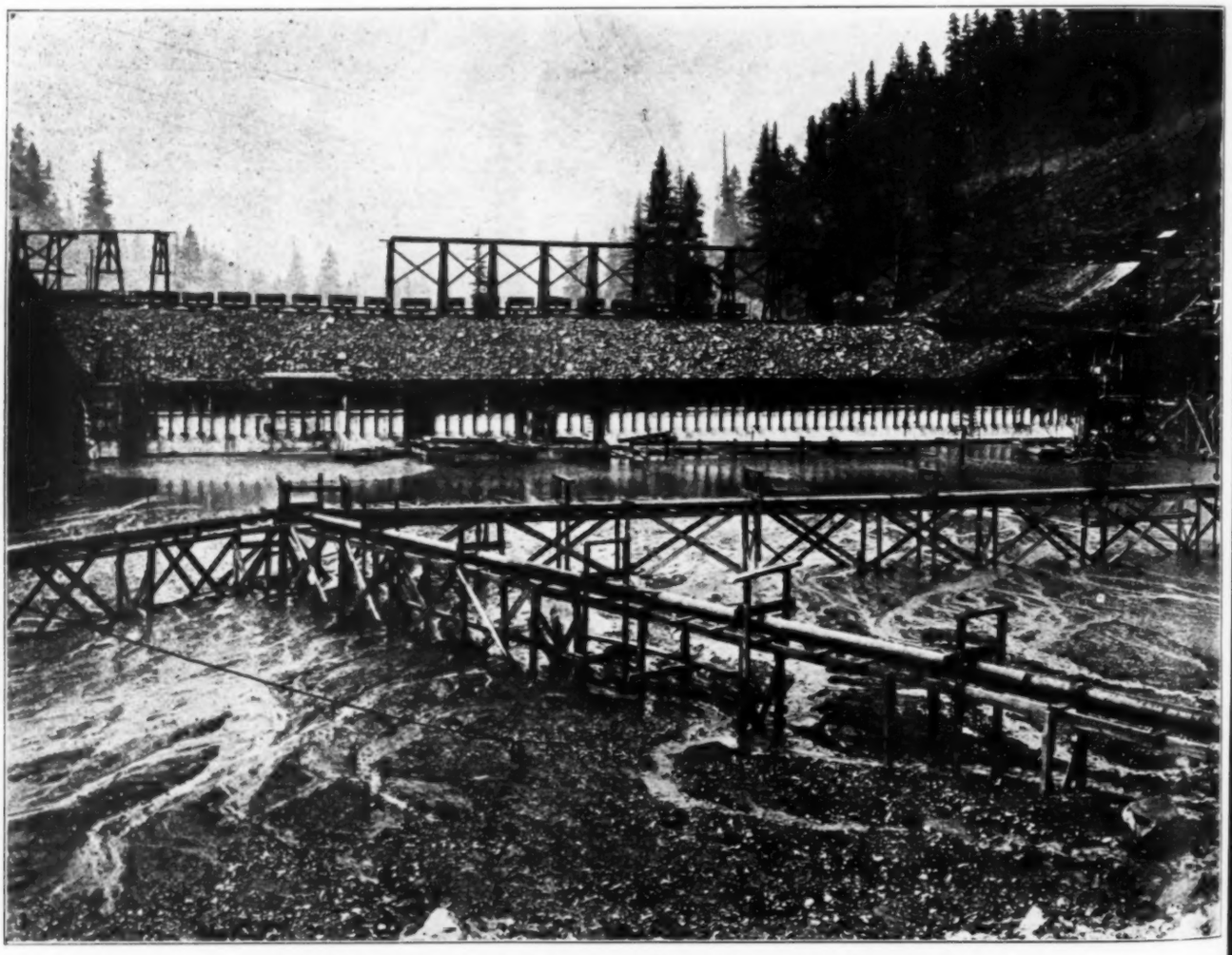
Job Begun During War and Abandoned for Three Years Is to Be Finished Next Year

IN the Yakima Valley, Washington, the United States Reclamation Service is constructing one of the highest earth dams in the world, the Tieton. It is built of earth heavily blanketed with rock, approximately 230 ft. high and 900 ft. long on the crest, with a concrete corewall of an approximate height of 330 ft. extending from solid rock to the crest. When completed it will create a reservoir having a capacity of 202,500 acre feet. This reservoir will cover 2500 acres and will handle the drainage for 187 square miles. The dam is located in the Mount Ranier National Forest on the Tieton River about 26 miles above Naches, Washington, the nearest railroad point.

Work on this gigantic project has been under way for more than five years. A complete camp was built in 1917 to care for 600 men, a temporary power plant was installed with a capacity of 270 kw., and 1400 of the total of 2200 ft. of diversion tunnel was excavated by the spring of 1918 when, owing to labor shortage and the demands of wartime conditions, the work was closed down until April 1, 1921. At that time an appropriation of $675,000 was made available for the work of the fiscal year. Since then the work has been going steadily ahead. It is estimated that the completed reservoir, including the roads, right of way and clearing, will cost approximately $5,000,000 and will be completed in the fall of 1924.

One of the features of the construction work up to the present time has been the excavation and placing of the corewall below the ground surface. This consists of a concrete diaphragm completely crossing the canyon and tied well into bedrock on the base and sides. Below the ground surface it is 5 ft. thick. Above the ground surface it tapers to 1 ft. in thickness at the top of the dam, is heavily reinforced and has no expansion joints. In the river bed it was necessary to excavate to a depth of 110 ft. to reach the proper foundation. The excavation tapers on the east side of the canyon to 35 ft. in depth; on the west side the bedrock is exposed.

This corewall was excavated by stoping. Three principal shafts were sunk to and into the bedrock. At the base of these shafts a large sump hole was constructed and pumps installed. Drifts 6 ft. high



SECTION OF TIETON DAM AND COREWALL LOOKING DOWNSTREAM

and 5 ft. wide were then driven in each direction along the line of the corewall and into the bedrock at a depth of not less than 5 ft. and sometimes as much as 30 ft., depending on the nature of the bedrock, so that the concrete would tie into good substantial foundation.

By this method, after the lower drift is completed the second floor is excavated by sloping the material through the roof of the first floor into mining cars, thence run to the shafts, caged, brought to the surface and dumped. Thus the material above the lower drifts is never touched with a shovel. It is simply picked or shot down and trapped into the cars. After two floors have been excavated, the lower floor is filled with concrete from cars that run on the second floor that is completed. Then the third floor is excavated and the second floor is filled with concrete. This method is continued until the surface is reached.

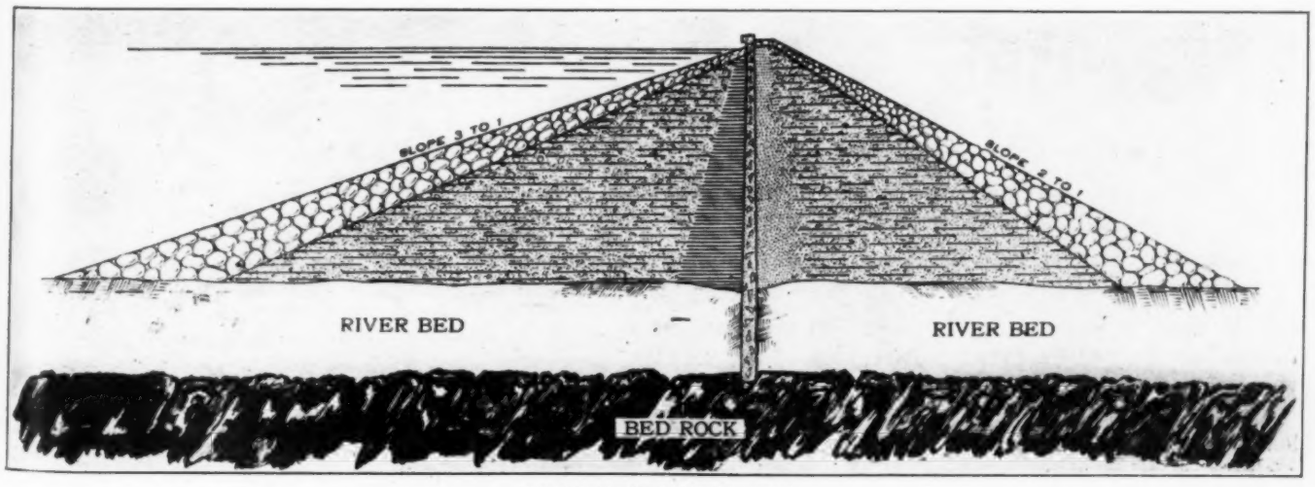
ANOTHER VIEW OF THE PROJECT

GENERAL VIEW OF DAM

In the course of the work on the Tieton dam much loose and swelling ground was encountered, as well as great quantities of water. This made the work very difficult in the section immediately below the river. Nevertheless this method has proved satisfactory, and in fact it is the only one considered practical in this instance because of the great depth to which excavations had to be carried and the nature of the materials encountered. To shore up an open trench to such an extreme depth would have been practically impossible.

The volume of the embankment is about 2,000,000 cu. yd. The earth and rock are excavated from the adjacent mountain sides with electric and steam shovels. Eight 16-ton locomotives have been used to haul the dump cars. The tracks from these pits run on to the slopes of the dam over trestles at intervals in elevation of about 30 ft. The material is dumped from these trestles and washed by hydraulic giants to a center pool that is divided by the corewall. A pump installed in the pool immediately below the corewall has been used to pump a large amount of the soft, clayey material from the lower side of the corewall to the upper side, leaving a fine graded sandy material against the downstream side of the corewall and a tight clayey puddle against the upstream side.

Tracks from all of the borrow pits are intercon-



CROSS SECTION OF DAM

nected, so that material from any shovel can be delivered at any point on either dump. This is in order to control the character of the material placed against the corewall in order that the equal pressures may be maintained.

The spillway is carved into the solid west abutment of the site of the dam. It consists of an overflow lip 390 ft. long, equipped with six submerging drum gates, each 65 ft. long and 8 ft. high. The water falls into a concrete-lined channel excavated through the side of the mountain, which carries the water into the river bed well below the toe of the dam. The spillway will develop a capacity of 50,000 sec. ft. before the dam would be overcapped. The water in the lower section of the channel will have a velocity of 100 ft. per second.

SPECIAL SCREEN SEPARATES SAND

Bucket Loader Does Its Own Proportioning on California Road Job

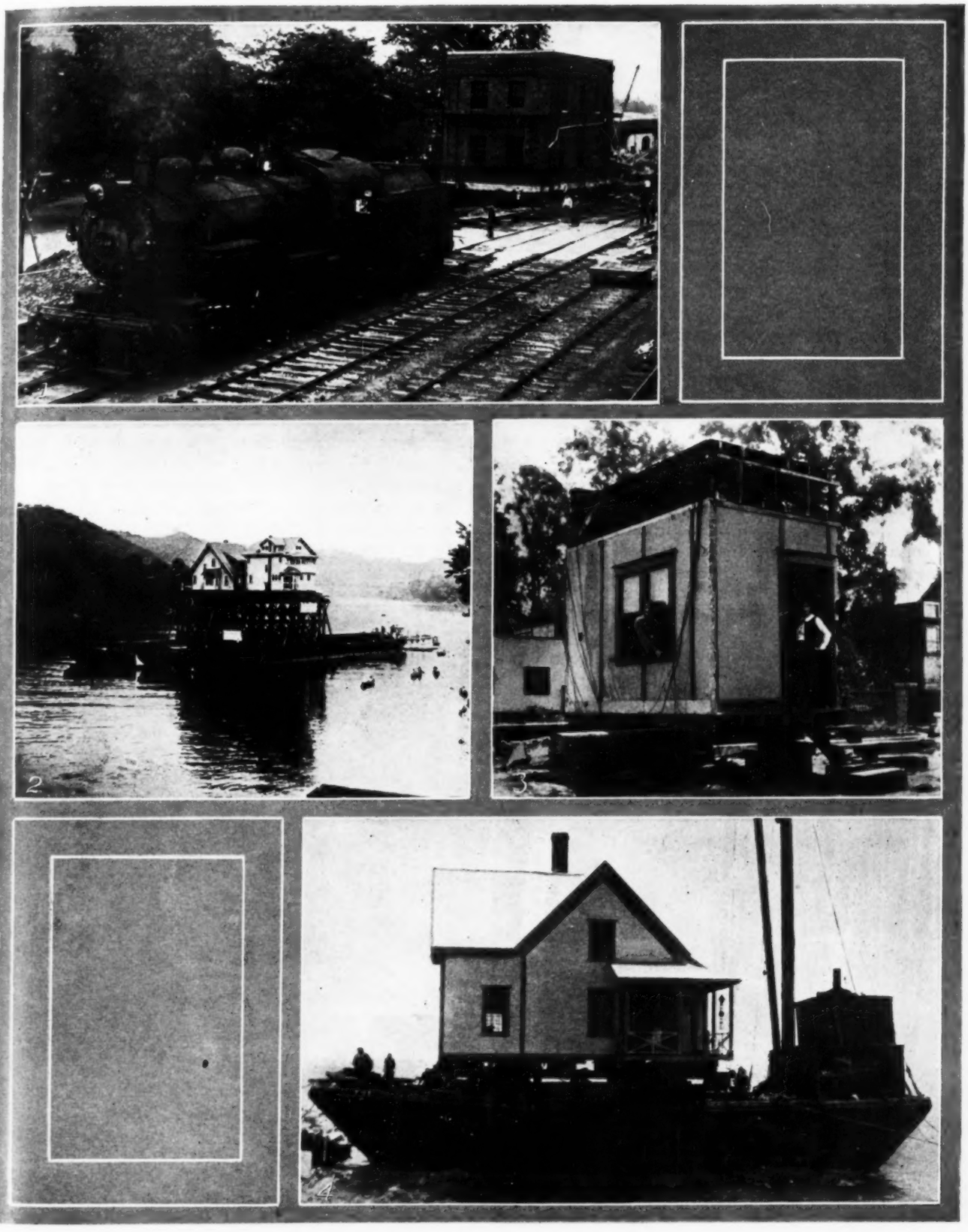
A RATHER ingenious method of making sure that only the right grade of gravel is used on a mountain highway job has been developed by Blumenkranz & Vernon, who are building a road near Plymouth, Cal. A good deposit of sand and gravel was found, but the sand content proved very spotty and varied from 10 to 70 per cent.

LOADING TRUCK WITH SAND AND GRAVEL

This handicap was overcome by equipping the bucket loader which was used with a special gravity screen with ⅜-in. wire mesh in place of the usual spout. An adjustable gate was put on the top of the screen, so that the material when discharged from the buckets would be deflected on to the screen high or near the bottom, thus keeping the sand proportion constant by the time it reached the motor trucks. This loader worked with a limited number of trucks, so that it was not busy all of the time, handled more than 300 yd. per day, and screened off at the side at least 100 yd. of sand, a portable belt conveyor being installed to remove it.

CLOSE-UP OF SPOUT WHICH DISPOSES OF SURPLUS SAND

Moving Day



1—This photograph shows a locomotive hauling a 1350-ton building in a railroad yard in Washington. © *P & A Photos*
2—The means used to prepare the site for the new Capitol at Charleston, W. Va. Twelve dwellings had to be moved across at Kanawha River. © *P & A Photos*
3—This photograph comes from Hollywood, Cal., where one of the big moving picture studios kept its telephone office in commission during a trip across the "lot." © *Keystone*
4—When a lighthouse keeper leaves his job, he takes his house with him. © *P & A Photos*

HIGHWAYMEN ON THE LAST LAP

Contractor and Engineers Are Working Their Hardest to Finish Work Before Snow Flies

BY the time this issue of SUCCESSFUL METHODS reaches its readers, the highway construction program for 1923 will be on the last lap. Every contractor who has a job to finish before cold weather puts an end to the work will be on his toes every minute and will be pushing his forces to the limit. In many cases night work will have to be resorted to in order to get under the wire, although in many States highway building at night has not become the fashion. It has been tried out with success, however, in different parts of the country and more than one contractor has made up his lost time in this way.

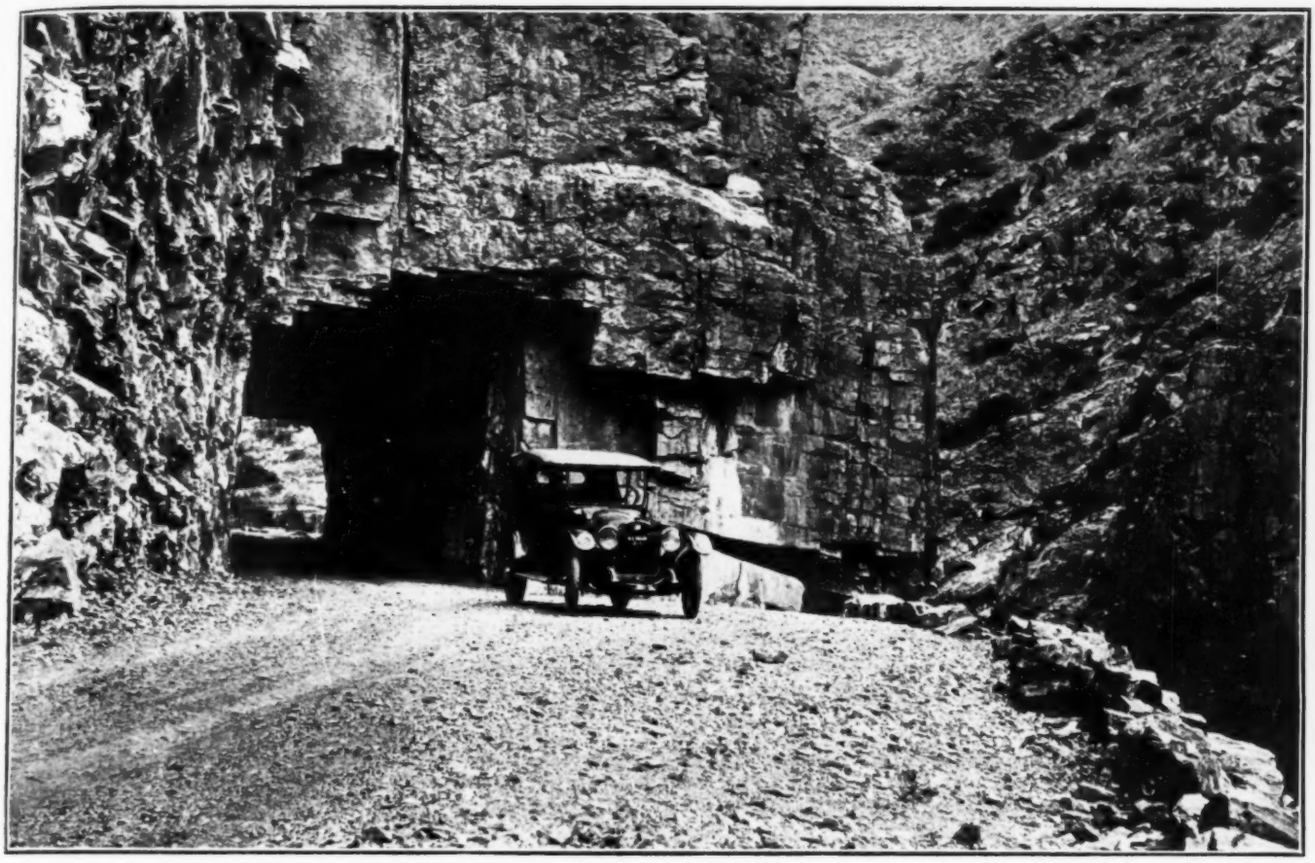
The East this year has had comparatively little rain and for that reason the number of unfinished contracts probably will not be as large as usual. In other sections of the country, however, this condition has not obtained and the carry-over into 1924 for the country as a whole will be larger than it really ought to be.

Road building is becoming more and more of a science each year, and with the continued cooperation of contractors and engineers delays are gradually being eliminated, and the time may come in the future when the feverish activity now being displayed will be unnecessary.

AN indication of the magnitude of the business of road building is contained in a report recently issued by F. S. Greene, State Superintendent of Public Works of New York. At the height of the season, he stated that there were 204 contracts under way for new construction and reconstruction. The number of men employed by contractors on State road work was 6821, and the State's own maintenance forces numbered 4838. At the time the report was issued the road contractors in New York State were laying approximately 1,000,000 sq. yd. of pavement per month.

New York has recently decided to help out the contractor by permitting any contractor who has submitted bids on a number of jobs at a single letting and has been declared to be the low bidder on any one of these jobs, to withdraw unopened his bids on other jobs if he so desires. This means that if a man has equipment enough for one job and finds early in the letting that he is low man for that particular piece of road, he may withdraw his bids on all other pro-

LAYING A BITUMINOUS SURFACE ON A VIRGINIA ROAD



A TUNNEL CUT THROUGH SOLID ROCK ON A FOREST ROAD IN COLORADO

jects. This privilege is being granted to contractors in Pennsylvania also.

NEVADA this year is spending $2,932,635.68 on road construction. Of this sum, but $459,945 consists of Federal Aid funds. The State's program for the year, the greater part of which is now complete, consists of: Graded highway, 156.87 miles; gravel, shale or crushed road surface highway, 435.06 miles; cement concrete surface highway, 40.72 miles; asphalt concrete surface highway, 1.59 miles; asphalt macadam surface highway, 22.15 miles; concrete, steel and timber bridges (13), 2198 lin. ft.

SOUTH CAROLINA's Highway Department is about to open a new testing laboratory, which will be housed in a specially constructed building on the campus of the University of South Carolina. The department put through a clever deal in order to obtain the equipment for this laboratory by exchanging for it a large quantity of surplus war material, consisting mainly of canvas. The new laboratory will be used for testing all materials which will go into the construction of roads in the State highway system.

THE worst cloudbursts in years have been a severe handicap to the road construction program in Wyoming this season. The State Highway forces have been kept busy repairing bridges and roads washed out by these cloudbursts, which have visited practically every portion of the State. In the State's most spectacular job, the Wind River Canyon highway, no appreciable damage was done, although the river was approximately 3 ft. higher than at any time since records have been kept.

PENNSYLVANIA, which always has been a leader in highway work, is voting this year on a $50,000,000 bond issue, the proceeds of which will be used to carry on the highway program. Special legislation has been passed which will make this money available much sooner than would ordinarily be the case. The present funds will be exhausted upon the completion of the 275-mile program now in effect, and to continue construction beyond that time it will be necessary to provide new funds.

The last $5,000,000 bond issue was passed in 1918 by a majority of 262,000, and since that time Pennsylvania has made the record in highway building which has put the State at the top. The proposal for the new bond issue provides that 20 per cent of the sum, or $10,000,000, will be set aside by the highway department with which to meet the various counties on a 50-50 basis.

MINNESOTA is now engaged in painting a stripe 4 in. wide down the middle of each State highway. A rebuilt army truck has been equipped for this work, the paint feeding on a rubber-tired wheel which applies it to the pavement. White paint will be used on the black pavement and black paint on the concrete. It is expected that the outfit will mark about 25 miles a day, and there are 216 miles of highway to be thus marked.

THE TOWER ON THE COVER

THE photograph on the cover of this issue of SUCCESSFUL METHODS shows the steel tower and chute which is being used by John A. Byers in the construction of a new bridge across the Shenango River in New Castle, Pa. At the present time Mahoning Avenue approaches the river across four railroad tracks at grade, runs through the switch yards of two or three railroads, and then crosses the river on an old steel bridge. Once across, it makes a very abrupt curve, parallels the river for 150 yd., and then goes directly away from the river.

Lawrence County and the State of Pennsylvania are cooperating in the building of the new bridge, which will carry the street over the railroad tracks to the river, and ties in with the old streets after it has made two short curves. The total crossings will be 1632 ft. in length from where the approach starts to where it meets the old street location. In this stretch of 1632 ft. will be about 700 ft. of approach laid between concrete retaining walls, two steel superstructures about 200 ft. long each, one about 225 ft. long, and a plate girder span over the railroad about 100 ft. long.

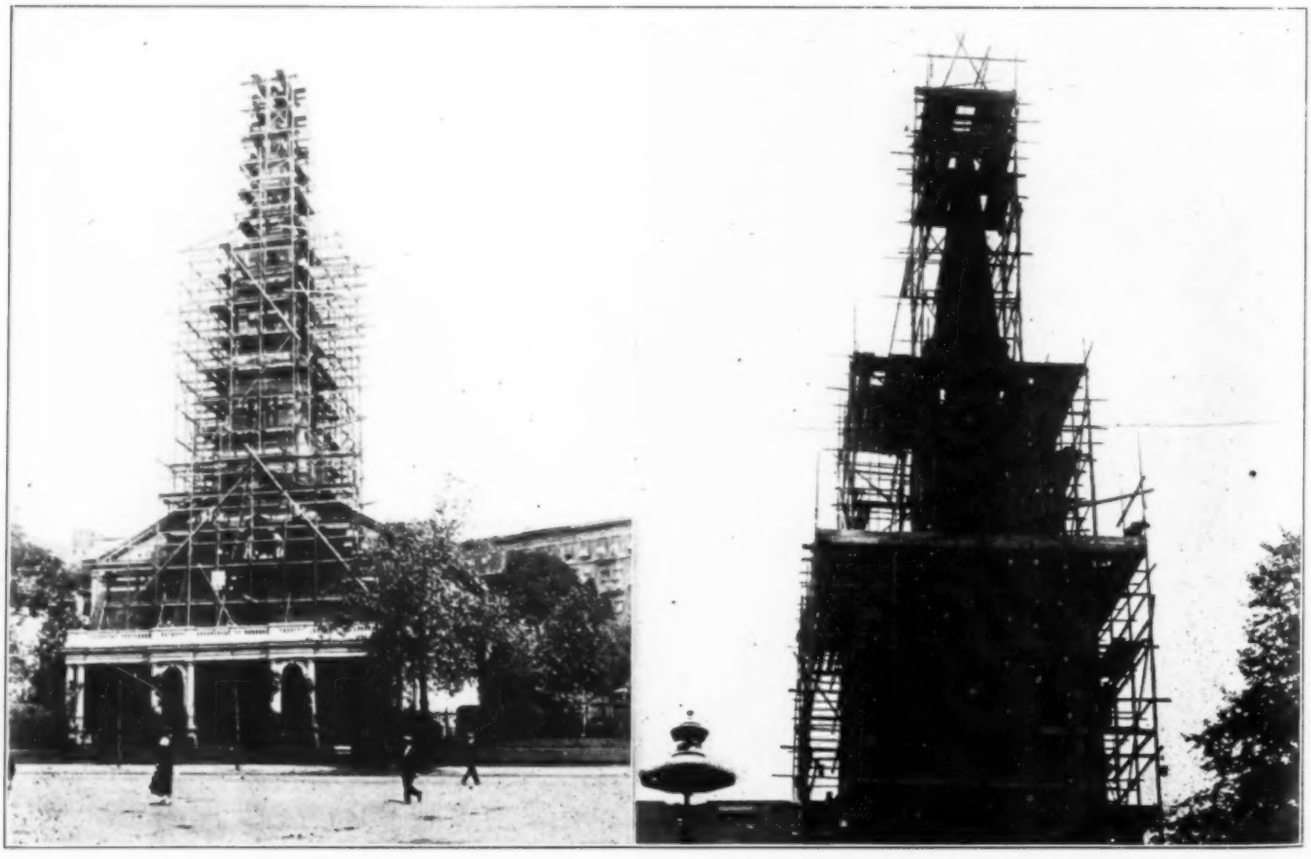
The photograph shows the tower just after it had been put up and when it was pouring the foundation for one of the piers close beside it. It is now pouring foundation about 500 ft. distant. Work on the bridge is proceeding at good speed.

ROADBUILDERS WORKING ON PROGRAM FOR CONVENTION AND SHOW

THE program for the annual Convention and Road Show of the American Road Builders' Association, which will be held in Chicago, Jan. 14 to 19, 1924, is now being prepared. It will provide for considerable more attention to the methods of handling construction and maintenance work and to the relation between the contractor, the engineer and material producers than has heretofore been the case. Definite announcement of the subjects will be made later.

As announced recently, C. M. Upham will be the manager of both the Convention and the Road Show and he is at present working with the directors of the Highway Industries Exhibitors' Association on plans for the Show. The Coliseum, the Coliseum Annex and the Greer Building will be filled with road building machinery of various kinds and every effort will be made to limit exhibitors to their latest products.

STEEPLE SCAFFOLDS IN NEW YORK AND LONDON



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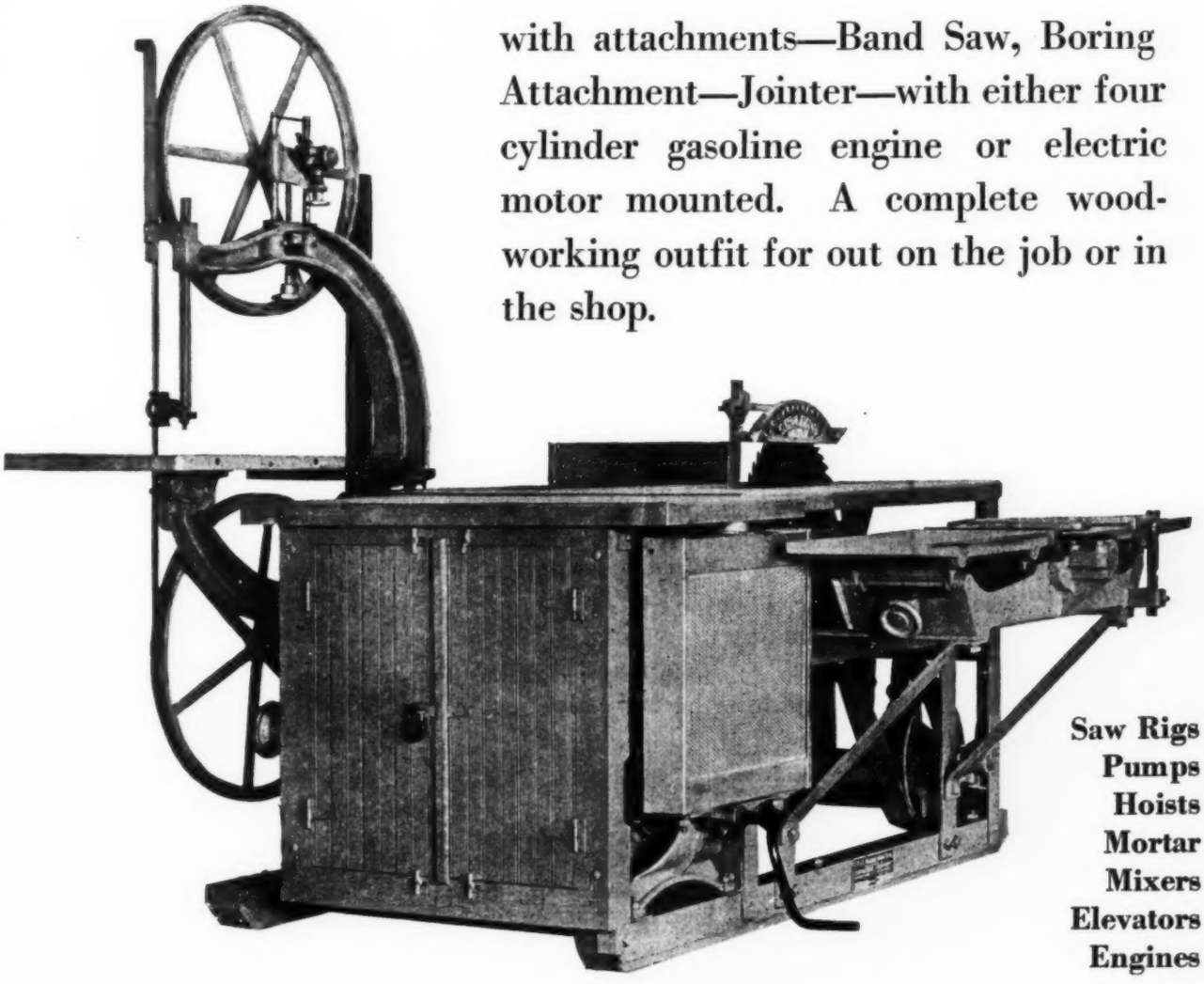

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The backbone of that equipment is your shovel. If it lays down on the job, you fail. It stands to reason that you cannot afford to take a chance.

The Thew shovel is not built for the gambler who wants to take long chances. It is the shovel for the man who wants to be in business tomorrow.

This man wants results today and every day, not a few short, snappy records. His operator wants something he can be proud of and brag about.

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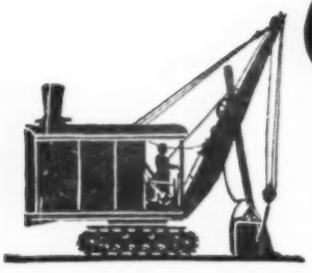
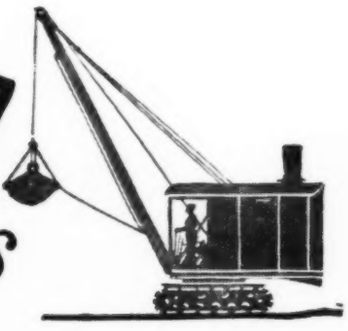


Thew Power Shovels



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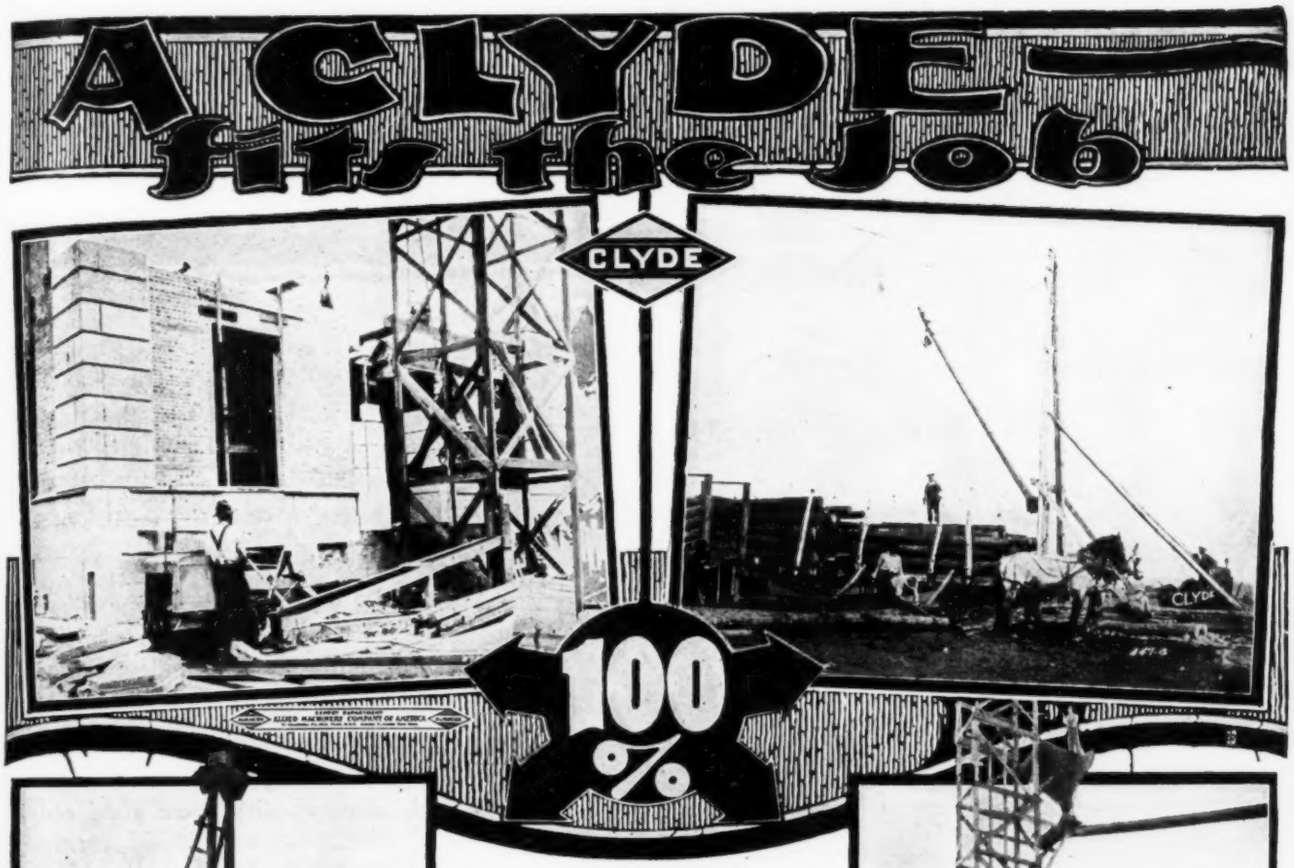

THE various illustrations shown herewith indicate different operations where the Clyde two-drum gasoline hoist is making good. In building operations, log loading, pile driving and many other occupations, it is more than meeting the expectations of the owners.

Satisfied users in all parts of the country voluntarily endorse the adaptability and the low operating cost of this Clyde unit. It is built of carefully selected materials, and carries a rigid guarantee against original defects. The unit is Le Roi powered. Complete information on request from the home office or any branch.

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New Zealand Knows The Answer!

Austin Motor Roller and Austin Scarifier giving a demonstration at Christchurch, New Zealand.

Still going strong after 10 years of active service. The Cook County, New Zealand, Council has recently added a second Austin Motor Roller to its fleet on the strength of this record.

WITH about a dozen manufacturers of steam and motor rollers in England, why do her colonies come to Chicago for their rollers in increasing numbers each year?

With high speed, four cylinder motor rollers offered at lower prices, why do experienced users stick to the slow speed, single cylinder Austin Motor Roller?

Hundreds of machines like the 10-year-old veteran in one of the photographs are the best possible answer; with their good old "one lungs" running as smoothly and silently as the day they left the factory. (Yanking around a 10-ton road roller, with no spring mounting, at three miles per hour is a far different matter from propelling a light, spring-mounted, rubber-tired automobile at sixty.)

Other reasons for the constantly increasing popularity of the Austin Motor Roller are given in Catalog "G". Your copy is ready

The Austin-Western Road Machinery Co.

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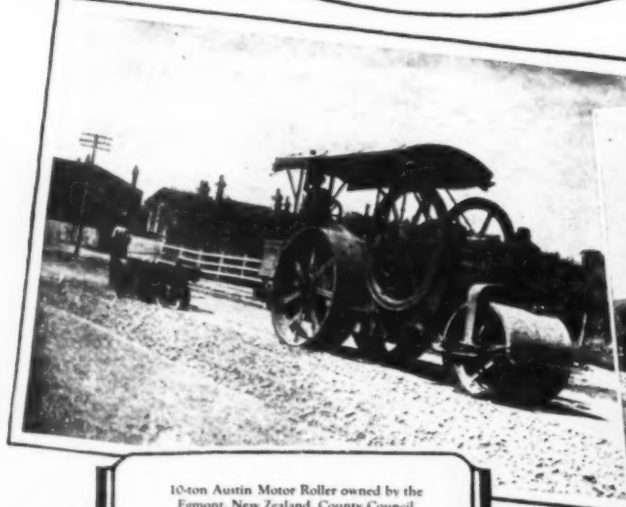
400 North Michigan Boulevard, Chicago, Illinois



10-ton Austin Motor Roller owned by the Egmont, New Zealand, County Council.

Austin Motor Roller belonging to the Piako, New Zealand, County Council driving a rock crusher.

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Over 6000 miles of concrete roads, including the Ideal Section of the Lincoln Highway, have been spread, tamped and surfaced with Lakewood Finishers. The Ideal Section shown below was built in two twenty-foot strips, a slight change in the Finisher wheels adapting it to work on the second strip.

This was the third large job for the contractor's Lakewood Finisher, Cars, Track and Batch Boxes.

THE LAKEWOOD ENGINEERING CO. CLEVELAND

1—REPLACING WHEELBARROWS. A Type U loading brick from a kiln for the Onondaga Brick and Tile Co. at Onondaga, New York. It shortens wheelbarrow hauls in this case. In others, it does away entirely with wheelbarrow work.

2—UNLOADING CARS. A Barber-Greene Type U being used for "hauling out" coal by the Martin Lumber Company, Geneva, Illinois.

U-Type Barber-Greene Portable Conveyor, equipped with electric motor.

3—LOADING FROM PILES. In this case, the material handled is oyster shell, and four Type U Barber-Greenes carry it from stock piles to barges. New Haven, Conn.

4—PIT WORK. A Type U handling gravel for Pierce and Piron at Aurora, Ill.

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U-Type Portable Conveyors—Unusually Useful

This conveyor is our one-man machine for universal use. It is 22 feet long, has a 12-inch belt of special patented construction with steel flights, every 18 inches, which enables it to handle material at exceptionally steep angles. Skirt boards run the full length of the belt, are 6 inches deep, and enable the conveyor to handle large lumps.

There is a crank operating a self-locking worm winch, for elevating the discharge end to any height desired, up to an angle of 35 degrees.

This conveyor generally displaces from two to ten men, depending on the nature of the work. As a rule, it handles about 26 tons of coke per hour, 44 tons of coal, and 90 tons of gravel. The amount per hour depends on the nature of the material and on the conditions of loading.

The type U has proven so popular in every state ot this country and in foreign countries that our volume this year has enabled us to cut our production costs considerably. Making this conveyor in a single width and length permits us to offer high quality at a low price. We have, therefore, reduced the base price (for the conveyor without power) to $350—a reduction of $125.

With a 3 phase, 60 cycle, 220 volt motor, the price is $453. Other motors are supplied on our usual price list for special motors. With Fuller and Johnson gas engine the conveyor is furnished for $485. All prices f. o. b. Aurora. Send for detailed description and catalog.

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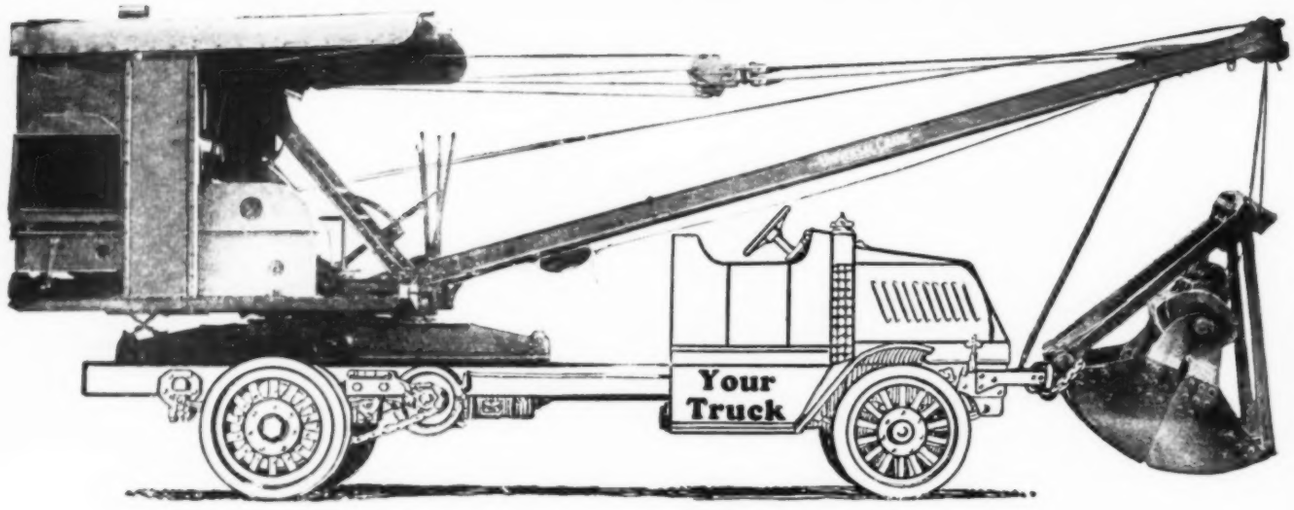
530 West Park Avenue :: Aurora, Illinois

BARBER GREENE
Portable Belt Conveyors Self Feeding Bucket Loaders



Mount a Universal Crane on Your Used Motor Truck

Full Circle Swing
No Outriggers

One job of Universal Crane Service—loading heavy machinery to trucks on the water-front. Cranes on this type of service keep fleets of trucks busy winter and summer handling coal and material for the smaller industrial plants and yards, digging cellars and doing innumerable crane jobs that earn large returns because the saving over manual methods is enormous.

G. M. C. mounted "Universal" excavating for street widening with clamshell bucket—handling 250 to 300 yards a day—crane wasted no time getting to or from this job.

The Universal Crane is a sound investment being a year 'round machine, which winter and summer, cleans up the work it would otherwise take a large gang of laborers to do. Through the winter you find them handling coal, iron, steel, etc. and bulk materials, or snow from the streets at the rate of two minutes per truck.

Universals have replaced from 20 to 30 men on different kinds of work. They handle 6 to 10 hopper and gondola cars of sand, coal, etc. per day under ordinary conditions. Such material handling is a direct answer to the present labor question.

You can have a Universal mounted on one of your 5-ton or heavier used truck chassis and you should earn from $50.00 to $100.00 a day with it. Do you wonder there are no used Universals available?

Let us tell you all about this *Full Revolving Crane* equipped with its own heavy duty, 4-cylinder gasoline engine developing 100% excess power. It is the *only motor truck mounted Crane* that handles a loaded ½-yd. grab bucket (3800 to 4200 lbs.) without outriggers or extra counterweight on good level ground at 17 to 18 ft. radius and at any position of swing.

Here are a few jobs on which "Universals" have saved real money:

1—Removing steam shovel ramps.
2—Excavating for cellars, tanks, sewers, etc.
3—Placing 3-ton cast iron or concrete pipe.
4—Cleaning up debris—wrecked foundations, etc.
5—Handling material from cars or storage to trucks at various points.
6—Loading snow—2 min. per truck load.

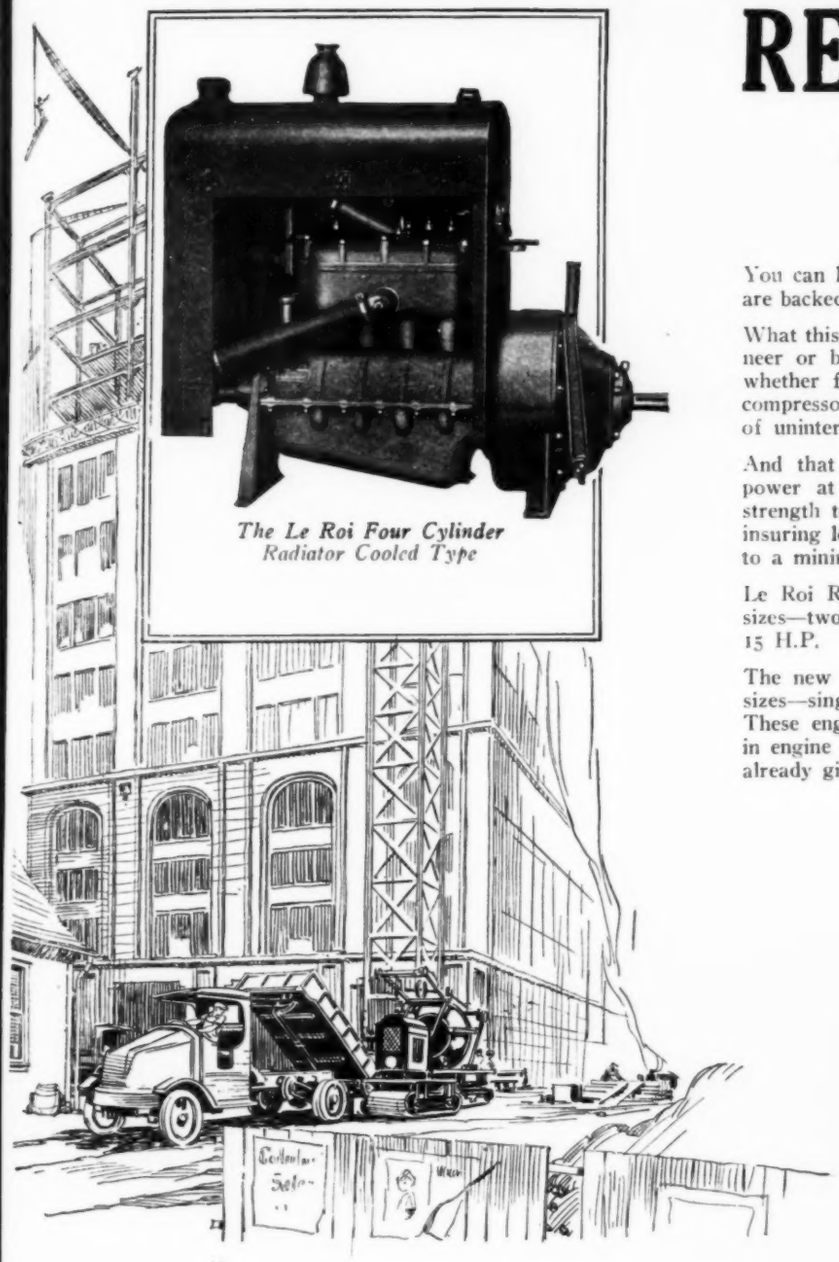
You will be interested in the well illustrated Construction Field Bulletin No. 22D.

Tear out this page now and mail with your letter head for a copy.

The UNIVERSAL CRANE Co.

1162 Swetland Building, CLEVELAND, OHIO

New York Office—141 Center St. Los Angeles Office—401-E Van Nuys Bldg. Chicago Office—908 Ellsworth Bldg.



The Le Roi Four Cylinder
Radiator Cooled Type

RELIABILITY

backed by years of reputation

You can have confidence in Le Roi Engines. For they are backed by years of engine building experience.

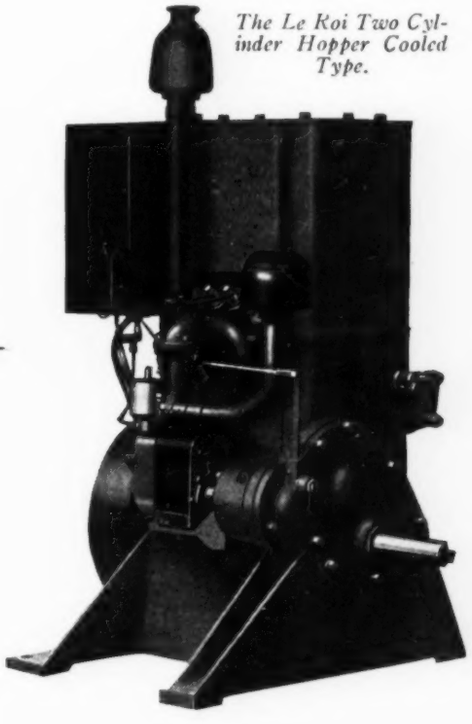
What this experience means to you as a contractor, engineer or builder is that your power unit on the job—whether for the concrete mixers, pumps, hoists, or air compressor—is designed and built right, to give years of uninterrupted service.

And that "service" means plenty of steady, unfailing power at the lowest possible operating cost. Extra strength to give extra power is built into every part—insuring long life, and reliability with vibration reduced to a minimum. All wearing parts are interchangeable.

Le Roi Radiator cooled type engines are made in two sizes—two and four cylinder—furnishing from 5 to 15 H.P.

The new Le Roi Hopper Cooled type is made in two sizes—single and double cylinder—furnishing 3 to 8 H.P. These engines are considered one of the greatest steps in engine construction. Contractors and engineers have already given them their hearty approval.

The Le Roi Two Cylinder Hopper Cooled Type.



If you want to know more about the quality and reputation of these famous engines, let us send you an interesting folder illustrating and describing in detail the various types and sizes.

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5908 Mitchell Street
MILWAUKEE WISCONSIN

LE ROI ENGINES

"for dependable power"

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. . to provide each user with the particular explosive that will do *his work* best and at least expense. That principle is the foundation of the du Pont Company's success—

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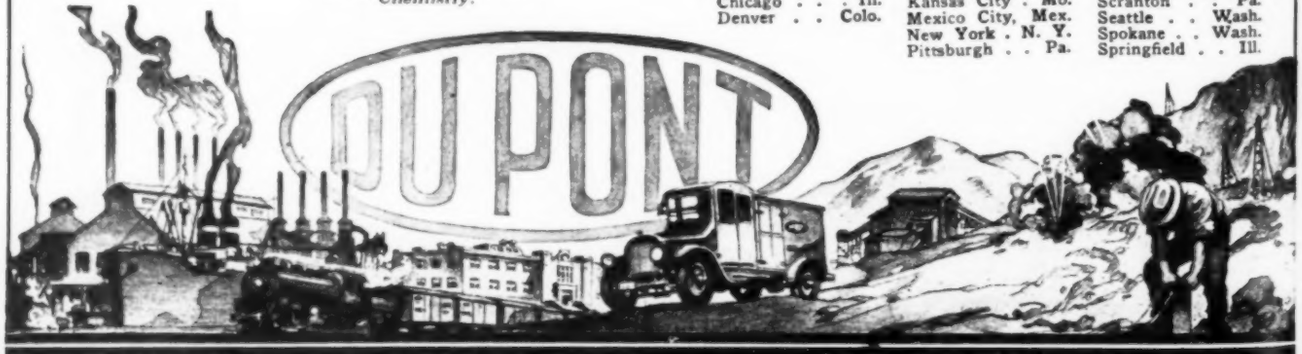

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